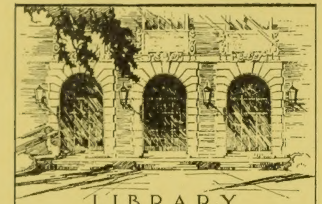

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

THE SAFEST YEAR

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January 1964

THE SAFEST YEAR

A year of substantial improvement and record low accident rates! This is the outlook for the 1963 USAF aircraft safety picture. At press time (early in December) the major accident rate—accidents per 100,000 flying hours—stood at 4.4, a rate significantly lower than the 5.7 rate recorded in 1962.

Indications, based on press-time figures, are that by the end of the year the 1963 rate will be less than 4.4. To record any dramatic increase will require a rash of accidents exceeding any recent experience. Further, this adverse condition would have to occur in a month of decreased flying. There is no indication of such a trend.

The aircraft fatality rate (total number of persons killed in aircraft) of 3.4 is another indicator of improvement in accident prevention. Previously, the lowest fatality rate ever recorded was 3.7 in 1960. The 1963 rate also reverses an unfavorable three year trend that saw the USAF fatality rate climb to 5.6 in 1962.

The fatality rate, however, can be affected by fortuitous events and caution should be exercised in accepting all of the improvement shown as indisputable proof of an improved level of accident experience.

More indicative of the level of success attained is the fatal accident rate (aircraft accidents in which there were one or more fatalities) which is expected to be down to 1.8 as comparred to 2.0 in 1962. However, the lowest fatal accident rate on record was the 1.5 achieved in 1960.

The aircraft destroyed rate, another valid indicator of improvement, shares the record low rate of 3.8 established in 1960 and shows a substantial improvement over the 1962 rate of 4.5.

The table below compares some annual rates beginning with 1946.

Due to the time requirement for detailed investigation and final evaluation, 1963 aircraft accident cause factors are still preliminary. As of press time there is no indication that accident causes will differ substantially from those of recent years. Pilot and materiel cause factors continue to predominate and will continue as areas to receive considerable prevention attention. Another area, "undetermined," is also being looked at more and more closely ("What Happened," page 2, this issue).

Despite a general leveling off of the major aircraft rate for three years, 1963 tends to support the contention that many aircraft accidents are still preventable. Continued diligence in reporting of all hazards is emphasized as a means of achieving the safety goal—eliminating preventable aircraft accidents. ☆

	Major Acft Accident Rate	Fatal Accident Rate	Destroyed Aircraft Rate
1946	61	7.6	20.9
1951	33	5.5	12.9
1956	15	3.1	7.5
1961	6.3	1.8	4 7
1962	5.7	2.0	4.5
1963 (Year end estimate)	4.4	1.8	3.8

Lieutenant General John D. Ryan
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•

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FALLOUT

RUNWAY STOP LIGHTS

Dear Editor—

Standing in the local snack bar recently, I was approached by an airman who asked me if I worked in the control tower. I replied that I did, and the following conversation ensued:

"Why did you people have the Air Police stop me after I crossed the runway?"

(At that time our runway had just been reopened after being closed for almost five months for repairs. The tower was having trouble getting the vehicles to stop for a light now that it was a "hot" runway. For protective measures we were having the Air Police stop vehicles that were crossing without a green light.)

I replied to the airman, "The only thing I can think of was that you crossed the runway without a light."

"But I did get a light," he said.

"Are you sure you got a green light?"

"Yes, I got a green and white light. That's the light for using extreme caution, isn't it?"

I wondered what controller would give him a green and white light when I remembered that the field was IFR on the day the airman was stopped. I asked him from where he got the light signal and sure enough he said he got it from the large tower located behind the control tower. I explained to him that he was receiving his light from the rotating beacon.

This incident may sound funny but I started checking with some of the other controllers and many recalled this same thing happening to them at some time or another.

One controller told me of an airman who crossed the runway when a red light was flashed at his vehicle. Later when questioned the airman replied that his supervisor had instructed him to watch for a light but didn't specify what type of light, so when given a red light he thought he was cleared to cross. This type of situation could get very serious, especially if an aircraft were touching down on the runway at the time.

I feel that all supervisors should take a look at their orientation programs and re-brief on light gun signals. They should also point out to the airmen just where to look for a light gun signal. Remember, the only signal that gives you clearance to cross a runway is a solid green or an alternating green and red which means use extreme caution. This signal will come from the control tower. The proper way to obtain either of these signals is to face your vehicle towards the tower and blink your headlights. This lets the controller know that you want to cross the runway. Then and only then you will be cleared to cross if you get the proper light. Permission to go on the airdrome, including the ramp and all taxiways, must be obtained from base operations.

A2C Lanny G. Heater
1952 Comm Sq AFCS

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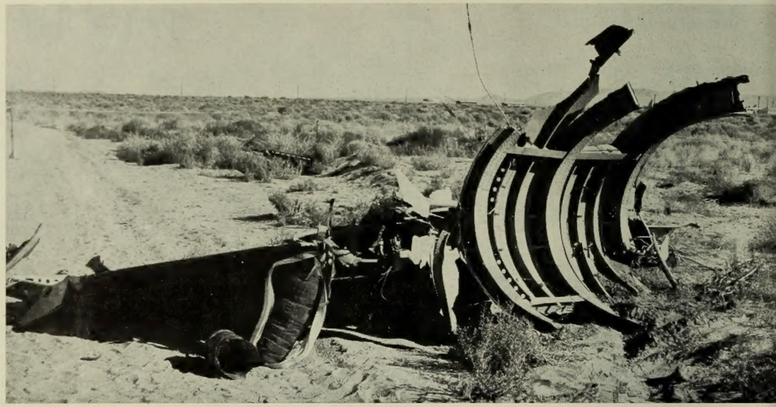


Every day of our lives, we in the Directorate of Aerospace Safety are faced with the accident investigator's perpetual question . . .

WHAT HAPPENED?

Lt Col Donald E. Miller, Directorate of Aerospace Safety

Let's set the stage for all that follows by briefly reviewing a recent accident wherein the investigative procedures and techniques left, to say the least, considerable to be desired.

Two Century Series fighters were returning from a gunnery mission when at 3000 feet the flight leader signaled for spread formation. The wing man smartly executed a 90-degree break from which he never recovered. Scratch one bird and chalk up another nylon letdown.

Now for some complications that resulted.

The destroyed aircraft belonged to one command, was being flown under the training jurisdiction of another command, and the accident was investigated by a third command owning the base nearest to the scene.

A "limited board" was convened consisting of four company grade officers, one a medical member, and one a recorder. Thus, the entire investigative effort was reduced to two people.

The investigating officer had no experience at all in the type aircraft involved and the pilot member very limited experience. The presence of a maintenance member would have added much to the quality of the investigation and the assignment of a senior, highly experienced officer as president of the board should have been a basic consideration.

The investigation consisted primarly of two interviews (one by phone) with the pilot involved and the findings based for the most part on the board's confidence in the pilot.

After the findings of the board were reviewed and suspected (and rightfully so, due to the perfunctory investigation conducted), no attempt was made to reconvene a board or reconsider further attempts to recover the aircraft.

Speaking of attempts to recover the aircraft, this was abandoned in the early stages, based on a decision by a base employee in the reclamation unit that attempts to secure the wreckage would be too expensive! Remember now, we're speaking of possibly saving a few million dollars worth of aircraft if we find the real cause of this accident versus the expenditure of a few hundred or possibly a few thousand dollars to recover the wreckage.

No apparent attempts were made to secure witnesses; maintenance on the aircraft was considered *professional* because the forms were up-to-date; over 50 per cent of the report consisted of reproductions of AFTO Form 781 Part II and AFTO Form 781A, the contents of which had no bearing on the accident other than to add to the weight—literally—of the folder; no apparent attempt was made to review similar accidents or request technical assistance or data from the prime AMA or the Directorate of Aerospace Safety.

The findings and subsequent recommendations were based on *ifs*. This led all concerned to start charging off in several directions for remedial action until the prime AMA and the command having accident investigation review authority threw some cold logic on the whole issue and put the trolley back on the track.

There was no indication that some of the more outstanding possible cause factors were reviewed, even though rudder lock was a prime cause factor suspect. Rudder lock on this particular aircraft can be caused by several things, some purely mechanical such as the rudder pedal hanging up on the side of the center pedestal. Large adverse yaw angles can be developed at low to medium speeds by abrupt application of aileron and/or rudder; failure of the yaw/pitch damper in this aircraft can also produce a hard over signal, full extension or retraction of the rudder actuator, failure of utility hydraulic system return line quick disconnect

. . . there are others. Discussion on these subjects was either omitted or not clearly presented in the analysis.

Anyhow, without the wreckage to begin with, how do you conclusively prove your findings? Now we are back to the *ifs* again and at best—in this writer's humble opinion—an accident with an undetermined cause.

Nothing is more fundamental to accident prevention than a thorough investigation of an aircraft accident. Every effort must be expended to determine the real cause.

It is imperative that new procedures be developed within the accident prevention field to preserve our combat capability. In this regard, a proposal has been made that commands form centralized/specialized investigation teams. Obviously, the use of command-wide resources to form such teams has a great deal of merit. The importance of having the most *highly qualified* individuals available to conduct investigations of accidents, particularly those with strong materiel failure or malfunction implications, will do much to decrease the "undetermined cause factor" rate. To insure success in such an endeavor, however, would require the formation of a workable pre-accident plan in which the selected individuals would be identified by name. From 1 January 1956 through 31 December 1962 there were 1624 major accidents involving jet bombers and Century Series fighters. Of these, the cause factors for 206, or 12.7 per cent, were never determined. Many times TDRs were inconclusive, vital parts were never located, wreckage was not recovered, accident boards relied primarily on the investigating officer (often not qualified) to lead the way.

Another investigative technique which should be emphasized is the use of flight simulators to duplicate the flight maneuvers that could have been a factor in the sequence of events culminating in the accident. The use of this technique materially assists the investigator in proving or disproving certain assumptions that must be made in order to determine the courses of action the board must explore.

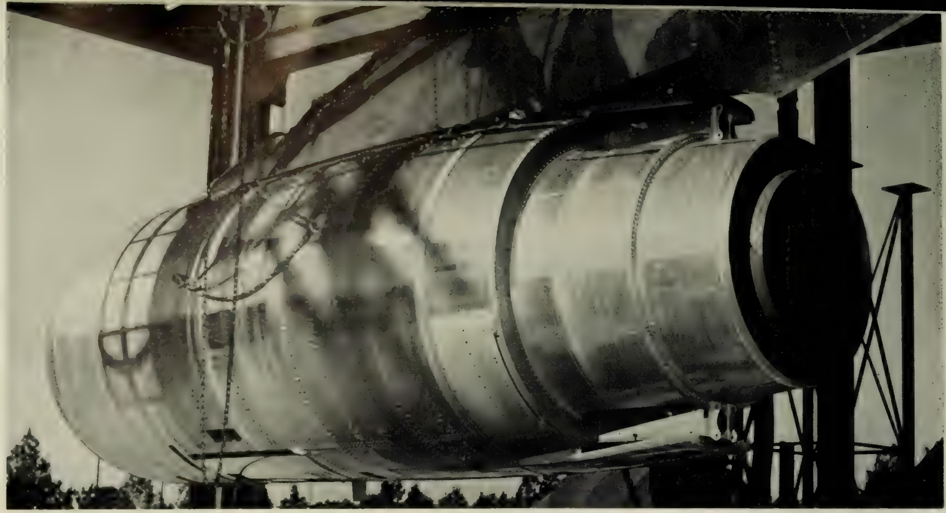
Recovery of wreckage is vital in finding cause of accident.

Another area, and one that can be controlled by the local commander to a great extent, is the careful selection of personnel assigned to standing accident investigating boards. Usually the accident investigating officer is a novice, not having had any formal training in the highly technical field of accident investigation. The Aircraft Accident Investigating Officer (AAIO) is the key man on an accident board. *The proper conduct of the investigation and the validity of the board findings and recommendations are directly related to the qualifications of the AAIO.* There is a serious shortage Air Force-wide of officers qualified to serve as AAIOs. Officers possessing AFSC 1925 who are graduates of the Flight Safety Officers Course and/or the Jet Engine Accident Investigation Course are normally the only trained personnel available for accident investigation. Several commands are requiring these prerequisites for accident investigation officers. Currently we are losing 30 per cent of all USC graduates per year to career progression, retirement, and change of primary duty. Air Force-wide, 161 out of 533 UMD authorized FSO positions are not filled by officers possessing AFSC 1925. The AAIO must be trained, identified and utilized in this highly specialized task if the quality of accident investigations is to be improved and a significant reduction made in the number of undetermined accident cause factors. Increasing the number of USC graduates would materially aid in solving this problem. *Use of all USC graduates in the Flying Safety Career Field is a partial immediate solution to the problem.* A method of identifying qualified AAIOs must be devised if maximum use of these experienced personnel is to improve. An ATC Short Course in aircraft accident investigation would aid in providing qualified officers.

As you have probably deduced by now, the foregoing discussions undoubtedly should result in some recommendations. They have—as a result of the 4th Annual Safety Congress Seminar. If recommendations of this group are acted upon, the percentage of "undetermineds" should decrease. For the sake of brevity, detailed discussion on these recommendations will not be undertaken in this article.

Remember: a better accident prevention program is a natural by-product of better accident investigations. We're not advocating that you conjure up cause factors, but when you reach an impassé and the recorder is about to use that word "undetermined" to close the board proceedings, take one more hard look at what you have, explore one more possible cause factor, check and recheck the accident scene, make another attempt to secure the wreckage, and talk to one more witness before the board members sign that Form 711.

Comparing the 1957 major accident rate of 13.6 with the projected rate of 4.4 for 1963 (destroyed aircraft rate: 1957, 7.5; 1963, 3.8—projected), one can say that we have made improvements resulting in an excellent accident prevention program. However, now is no time for complacency. Let's explode this myth that we have reached the *irreducible minimum* by taking a healthy cut at the undetermined cause rate by improving our investigation techniques and procedures NOW] ☆



BIG PUSH

Jack G. Gilley, Aviation Safety Engineer, Lockheed-Georgia Co.

One morning early in June of this year a freight car full of thrust arrived at the receiving dock of the Lockheed-Georgia Company. This prodigious shipment of power was packaged in four containers, each slightly larger than a compact car. Stenciled markings identified each as being one Pratt and Whitney TF-33-P-7 engine destined for installation on the first C-141A StarLifter.

The combined power of the four turbofan engines is 84,000 pounds in the static condition, with a total reverse thrust up to 53,000 pounds.

The TF-33-P-7 engine officially passed the Military Qualification requirement and received the FAA Type Certificate on March 26, 1963. The first production engine was accepted on March 28, 1963.

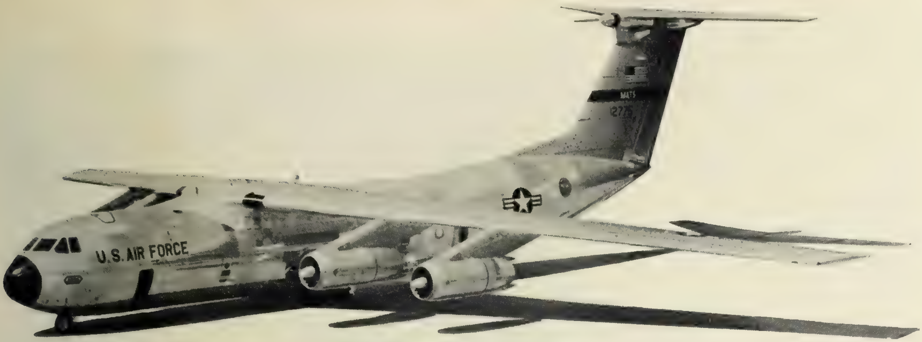
The predecessor of the TF-33, the JT3D turbofan, had accumulated over one million hours of commercial airline service and the experience gained in this worldwide usage was applied to the advanced design. Changes and improvements were evaluated and tested prior to incorporation. To obtain full qualification of the production engine, Pratt and Whitney compiled a total of 7623 hours of test on 11 development engines. Eight endurance runs of 150 hours each and extensive operation in the environmental laboratory at Eglin Air Force Base at temperatures ranging from minus 65 degrees to plus 165 degrees Fahrenheit were accomplished. A comprehensive flight test program with the TF33 installed in a special wing pod on a B-66 rounded out the initial test and development phase.

Since September 1962, a prototype pylon and nacelle have been undergoing development testing at the Lockheed-Georgia Company plant. The engine test stand accommodates a C-141A wing section with provisions for a landing flap attachment and pylon and nacelle installation. A specially designed "wind machine" powered by a P & W R2800 reciprocating engine generates a blast of 143 miles per hour velocity to create the effects of flight air flow, gusts, and cross wind conditions.

Three pre-production engines were delivered in mid 1962 for operation on the engine test stand. These engines were used for development testing of the prototype engine inlet, the fan exhaust hardware, and for evaluating power plant systems and accessories. Components developed on the test stand were sent to PWA for further testing with production engines to insure compatibility between nacelle and engine components.

The test stand is presently being used to obtain Air Force and FAA approval of the C-141A engine thrust reverser system. In the near future Lockheed will install a production engine and nacelle and will continue extensive testing of engine /nacelle compatibility including cooling, sonic fatigue, fire detection, vibration and noise and inlet anti-icing. A 150 hour nacelle endurance test simulating operating conditions is programmed for completion prior to airplane first flight.

In the meantime, the installation of the first four production pylons and nacelles has been completed on the first C-141A which has been rolled from the manufacturing plant and is getting into flight testing. Design of the power-plant attachment to the aircraft and details of engine cowling, including the inlet and ex-



Four big engines providing 84,000 lbs. of thrust will push Air Force's new C-141A Starlifter.

haust areas, were selected to meet or exceed the requirements of Pratt and Whitney. Engine isolation for fire protection, inlet and exhaust air flow, cooling provisions for the engine and associated equipment, and anti-icing provisions are some of the factors that influenced the configuration.

The TF33-P-7 is suspended from the under surface of the C-141A wing by a pylon made up of a box section faired by leading and trailing edge assemblies. A horizontal firewall forms the bottom of the pylon and extends over the top 90-degree included angle of the nacelle.

Each nacelle is divided by vertical firewalls into three compartments: the aft exhaust nozzle assembly, the combustor-turbine section (Zone X), and the accessory-compressor section (Zone II). Cowl doors provide easy access to equipment for inspection and maintenance.

The Lockheed designed "zero length inlet duct" locates the fan inlet guide vanes almost flush with the front of the nacelle and allows air flow into the fan and primary compressor with minimum drag and maximum efficiency. Primary compressor air discharges into the engine combustor section and exhausts through the turbine and primary exhaust nozzle. Fan discharge air is carried through two long kidney-shaped ducts extending along the sides of the engine merging into an annular fan discharge duct surrounding the primary nozzle assembly.

This long fan discharge duct arrangement was an important factor in the selection of the thrust reverser configuration. A target-type reverser consisting of two doors and actuating mechanism completely external to the primary and fan discharge ducts was the optimum choice. Advantages over alternate configurations were simplicity of design, minimum drag when stowed, and a significant savings in weight. The two doors are attached to each nacelle through a series of linkages and hinges and are extended during reversing to deflect both the primary and secondary exhaust gas streams. The thrust reverser hydraulic system is pressurized by a pump mounted on and driven by each engine and shares fluid with the Constant Speed Drive unit. Each engine thrust reverser system is totally independent of those for the other engines.

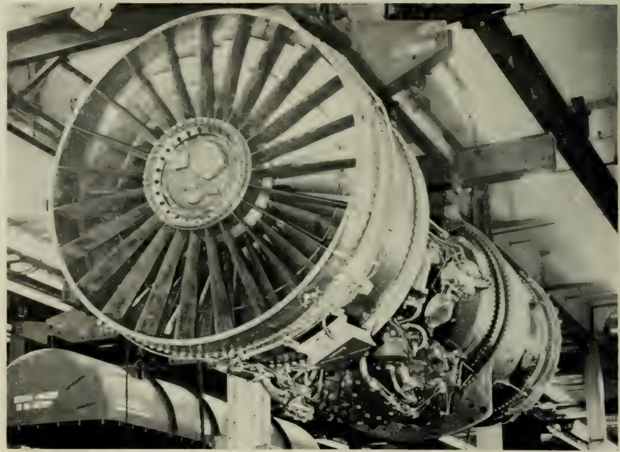
The thrust reverser system is designed for ground operation only and the reverse thrust developed combines with the engine inlet ram drag and the drag of the extended reverser door to give valuable improvement in stopping capability during landing roll or during a rejected takeoff.

Operational safety or "Design with the Pilot in Mind" was the

Pratt and Whitney TF33-P-7 engine during cold weather tests at Eglin, in flight on B-66 test bed.

watchword for the engineers responsible for the engine throttle control system. A mechanical control system made up of levers, control rods, bellcranks, cables, cable drums and pulleys was selected on the basis that past experience has proved this to be the most accurate, reliable and troublefree approach.

The throttles have a total travel of approximately 80 degrees from full forward thrust to full reverse. At a position approximately 51 degrees from the full forward thrust position a ramp in the quadrant stops throttle movement at a "start idle" position. A separate and distinct action by the operator, lifting the throttle 1-1/8 inches, permits movement into the reverse range, actuating the electrical-mechanical control system applying hydraulic pressure to the reversers and extending the reverser doors in less than two seconds. Increased reverse thrust is applied by continued aft movement of the throttles once the doors are extended and the interlock releases. Engine power in reverse is limited to a maximum value by an adjustable stop provided in the throttle quadrant which will be set before each takeoff and landing to compensate for ambient. The thrust reverser doors are retracted by moving the throttles forward into the forward thrust regime. The doors retract within five seconds with the engine at idle speed.



Powerful turbofan engine being readied for installation in new transport.

The spacious arrangement of the C-141 flight station dictated dual throttles for ease of operation from either pilot's seat and full engine control is attainable from either position. The throttle cable system is designed to protect against slipping or creeping from a selected power and against unwanted rapid throttle movement in the event of a control cable separation.

Protection against inadvertent reverser actuation in flight is provided by the fixed quadrant ramp, by incorporation of two valves, one mechanically actuated and one electrically controlled. Both of these valves must be operated before "extend" pressure is applied to the door actuators. In addition a mechanical stop is positioned by the throttle linkage to block "extend" pressure when the throttles are in the forward thrust range. The reverser door actuating mechanism locks over center when the doors are retracted.

The possibility of serious assymetric power in reverse if one set of doors should fail to extend is prevented by an engine control system interlock that limits power application in reverse until the doors are properly extended.

Safety considerations for both flight and ground operation are evident in other propulsion sub-systems.

The engine pneumatic starting system, providing completely self

Wind machine subjects C-141 engine to crosswind conditions, gusts and effects of flight air flow.

contained starting capability, is a prime example of simplicity in control. A guarded push-pull type switch energizes the system and applies pneumatic power to the starter from the Auxiliary Power Unit air source, from bleed from another engine or from an external power source. The starter control system includes automatic cut-out action, a light that illuminates whenever the button is depressed, and a separate independent indication that the starter air valve is open. The starter has been demonstrated to safely contain the metal fragments resulting from a starter turbine blade disintegration at speeds which simulate the maximum probable failure condition.

In order to provide engine isolation in the event of equipment malfunction or failure, the propulsion sub-systems are completely separate as to function on each engine. Fuel, lubrication, instrumentation, control, thrust reversing, and other functions are independent so that failure of any sub-system will affect only the one engine with which it is associated.

Fire prevention and protection features include the prevention of the spread of fire by firewalls, the separation of combustibles from ignition sources by baffles, the drainage of spilled combustibles from compartments, and structure to contain the fire within the nacelle long enough to allow detection and extinguishment. Fire emergency shut-down is accomplished by pulling a single fire emergency handle for each engine.

Test and development of the C-141A StarLifter power package will continue both on the test stand and in the air as the flight test program gets underway. Every aspect of engine operation will be recorded for analysis by special instrumentation in the test aircraft. Flight in inclement weather, turbulence, and ice is on the program. All grades of approved fuel will be used to assure suitability under all conditions. Flight test pilots and engineers from Lockheed, the Air Force, and the Federal Aviation Agency will all have an opportunity to evaluate and report on engine performance and control, and they will all contribute to the final recommended operating procedures which you will use to safely service, maintain and operate the StarLifter. ☆

TWX's

ACCIDENTS, INCIDENTS AND ALMOST . . .

▶ WHO'S MINDING THE STORE? The jet transport was at flight level 350, Mach 0.82, IAS 278 knots. The copilot was busy filling out forms. The panel engineer called the pilot's attention to an indication of generator difficulty. No one noticed that the generator OFF light had illuminated simultaneously with the onset of the generator problem. In the next two minutes:

> Over 1000 feet of altitude was lost, Mach increased to 0.86, heading changed 40 degrees and bank angle reached 20—30 degrees.

During recovery much buffeting was experienced and 2.9 G were recorded.

▶ A MATTER OF INTERPRETATION. A mechanic on the interphone signaled to the ramp coordinator that he had no communication with the crew. The ramp coordinator misinterpreted this to mean "Clear to start Nr 2 engine." He signaled the pilot accordingly. The pilot misinterpreted the signal and started Nr 3 engine instead. Luckily, the traffic specialist standing near the rear belly compartment door escaped burns from the jet blast as the engine started.

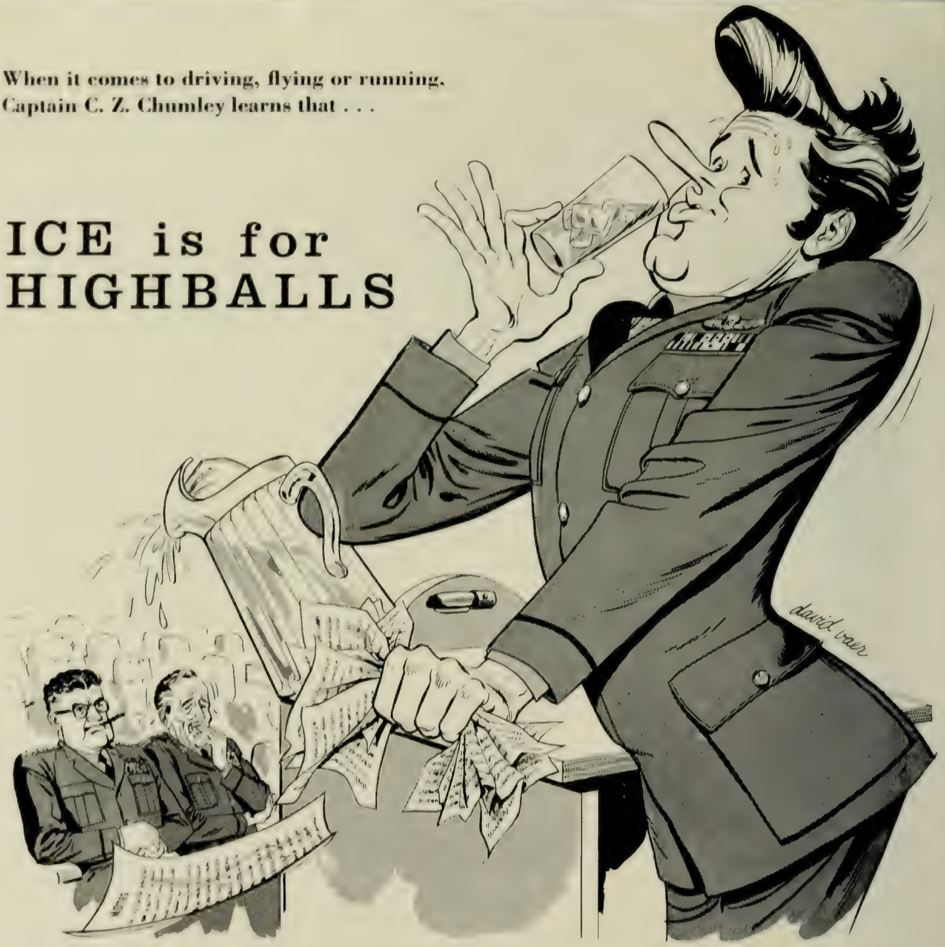
▶ "IDLE" RAIN REMOVAL SYSTEM. On GCA final the '135 broke out at 500 feet, in a heavy rain shower. Visibility good with rain removal on and RPM approximately 80 per cent. After crossing the end of the runway, throttles were retarded to idle and flare for landing was initiated. At that time forward visibility was reduced to zero due to inefficiency of the rain removal system with engines at idle RPM. The only reference for keeping the aircraft aligned with the runway was the runway edge which was visible through the lower left corner of the Nr 1 and Nr 2 pilot's windows. The runway centerline was not visible for approximately five seconds after touchdown. When engine RPM increased during thrust reversal the rain removal system again became effective.

AERO CLUBS

▶ Reference A Hard Look At Aero Clubs (page 20, December issue). Following is a message from Hq USAF to all major commands: QUOTE Five members of the Air Force have been killed during an 8-day period in Aero Club aircraft accidents as a result of questionable pilot proficiency, marginal weather conditions or inadequate clearance procedures. Effectively immediately, the following controls will be imposed: Members of Air Force Aero Clubs will file DD Form 1080 for all local flights and DD Form 175 for all cross-country flights with base operations when departing from a military base. A rated pilot designated by the base commander will clear all flights of local Aero Club aircraft to insure currency of pilot in the aircraft to be flown. Major commanders will insure that comparable clearance procedures are established and implemented for Aero Club aircraft operated on military bases. AFR 34-14 will be revised earliest to reflect these controls. UNQUOTE ☆

When it comes to driving, flying or running, Captain C. Z. Chumley learns that . . .

ICE is for HIGHBALLS



Archie D. Caldwell, Directorate of Aerospace Safety

"Are you sure that he's out there? I mean, that he just walked in and sat down?" The "World's Greatest Aviator," Captain Chauncey Z. Chumley, looked apprehensive as he asked the question. It wasn't every day that the commanding general would visit the base and decide to make an impromptu visit to the monthly safety meeting—especially the one meeting being conducted by C.Z.

"No doubt about it," Major Pasentino replied. "You can see the staff from here. He's sitting with the Commander in the first row. Here's your chance to make a lasting impression. It's thirteen hundred—you're on!"

Chaunce fumbled his notes together and, with the practiced ease of one who has had to bluster his way through many times, entered the stage right and moved quickly to the lectern. He decided against the joke about the bikini and the grandmother and plunged right in.

"General Twister, Colonel Martin, Gentlemen. As you know, this month's theme for the base accident prevention program and the topic of my discussion at this safety meeting is, The Winter Months. Now that ol' Jack Frost is upon us for sure, it's time we mention a few of the known hazards associated with the winter season."

A blast of sub-freezing air hit the old base theatre and the sound of sleet on the metal fire doors added a timely emphasis to C.Z.'s remarks. A cold draft fluttered lose pages of notes. A "second balloon" in the rear sneezed four times in rapid succession. C.Z. waited for the laughter to quiet down, and continued.

"Now I have made up a little 'Cold Weather Safety' checklist which will be on the stand in the lobby. As you go out, pick up one and consider each of the items. You may want to add some of your own. The whole point is to be aware that things are different when there's snow up to your—to a tall Indian's earlobes, and the temp's down to nothing."

Chaunce paused, drank from a glass on the lectern, grimaced at the taste of pure water, shuffled his notes, dropped one, bumped his head as he reached for it, tripped over the mike cord and finally staggered back into position. His thinking keeping pace with his footwork, he commented, "You can just imagine how much more dangerous that would have been had the stage been icy.

"I'll just run through some of the items now for you. We'll start in the home and, since almost all of you are involved in flying, end up with your profession. May I have the slide, please?" The lights dimmed and the slide projector clicked to life. Chumley read from the card he had retrieved.

"First, adequate food intake. You use more fuel in the winter; good physical condition keeps you alert, and you're less susceptible to germs, flu and colds. Adequate clothing for work and play; when you're cold, you don't perform as efficiently and tend to be more susceptible to injury. Gas heaters that are unvented still take their toll of Air Force personnel and families. Fires from overheated furnaces or blocked chimneys are yet another hazard. Make a safety survey of your own home front—see how many hazards you can uncover and correct. That done, you climb into the family bus and head for the office.

"Winter driving requires extra care and a car in top-notch condition. Lights, tires and skid chains, if needed, should be in A-number-one shape. Speed on icy roads should be cut considerably, and the money you put out for extra care, can save your life. Mufflers should be in good working order. We lost quite a few troops last year from carbon monoxide poisoning—while driving or stopping with the windows closed tight, and a leaky muffler.

"O.K., so you make it to the office or flight line; preflighting the coffee urn is only the beginning, especially for you maintenance officers. You have all sorts of directives on the winter care and feeding of airplanes, deicing, snow protection, and so on, but what about your crews? Do they have adequate shelters and work areas? Are they expected to load aircraft or make critical adjustments with hands that feel like they've been in a deep freeze for the last four hours? Are they alert to the dangers of working around aircraft when their parkas give them a furlined, tunnel-shaped vision field? How well briefed are your drivers? Is all snow removal equipment in good shape? How about GCA and navaid units? The list can be endless if you think about it for awhile."

Chumley looked at his watch. He had run overtime and had a similar presentation at the base gym for the NCOs and enlisted supervisors.

"Well, it seems I'm a little late so I'll conclude my presentation by introducing Major Strum, who will speak briefly on the base fund drive."

C.Z. left the stage at a half-trot and headed for the exit.

At the conclusion of the program, the General and Commander were slowly walking toward the rear exit. "Good presentation, Harry. You say that was Captain Chumley, the one who has been a problem? Seems like he may have shaped up."

"Well, General, maybe it's just my own feelings about him but . . ."

The sound of an approaching siren cut the Commander's words. The wail came closer and appeared to stop at the rear of the theater. The two quickened their steps to the exit while getting on overcoats, gloves and scarves. The flashing red light of an ambulance cast an eerie glow onto the snow and the figures in white, lifting a groaning shape onto the litter.

"What happened here, Sergeant?" The Colonel approached one of the ambulance attendants.

"Nasty break, right leg. Looks like a compound. The fella who called us said this guy came flying out of that exit, hit the ice on the steps and did a half gainer before he piled into the telephone pole and sidewalk. Gosh, you'd think a guy would know better than to try and run on ice like we've had around here."

The ambulance had pulled away headed for the hospital. The staff car with the General and Commander pulled away from the curb before the General spoke.

"I didn't get a look at the chap who fell. An officer?"

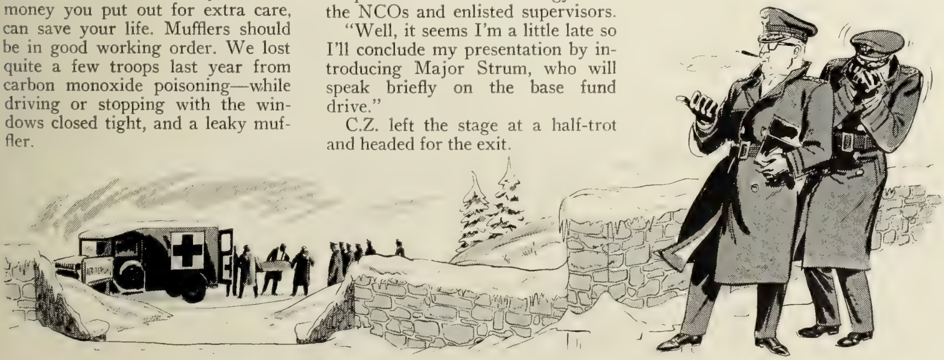
"Yes, General."

"A captain?"

"Yes, General."

"Don't tell me it was—"

"Yes, General." ☆



Fording The Jet Stream

Considerable attention continues to be devoted to turbulence associated with jet streams. Since there are often no indicators such as cloud formations to denote its presence, careful attention to available weather information and liberal use of seat belts in jet stream areas can best assure a comfortable ride. It is most timely as, in the winter season, the jet stream moves farther south, drops to a lower altitude and is generally stronger at normal jet flight levels. The following review of the subject includes suggestions on anticipating and avoiding jet stream turbulence.

A jet stream is a belt of strong winds embedded in the upper atmosphere and meandering in a wavelike pattern around the globe. While the strongest winds are in the core, most turbulence occurs in areas away from the core where the wind velocity changes most rapidly in either the vertical or horizontal plane. Since wind shear is usually accompanied by rapid changes in temperature, we can often associate areas of turbulence with those areas on the weather chart where the temperature gradient is largest.

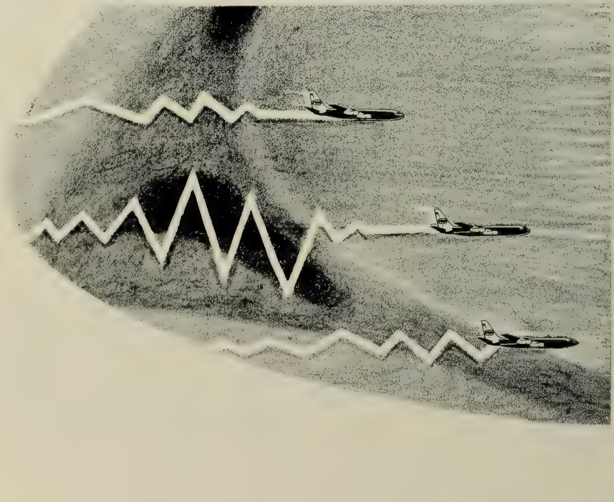
We have long known that significant turbulence can occur where wind velocity varies five knots or more per thousand feet, and that this condition usually occurs when the temperature changes roughly five degrees or more per two degrees of latitude (120 nautical miles). Also, studies have indicated that turbulence often occurs when wind velocity changes more than about 50 knots in 150 miles horizontally. These rules are used by the meteorologist in defining turbulence areas in his analyses and forecasts. The pilot does not often have access to such detail while in flight, however, the winds analysis forecasts describe the location of jet streams and associated areas of turbulence.

Since the turbulence areas are localized and are carried by the wind, the roughness experienced by successive flights on identical paths only a few minutes apart may vary considerably. The following general rules may be of assistance to the pilot, however, in alleviating jet stream turbulence effects:

- If the flight path must "ford" a jet stream, it is best to select an altitude either below or above the altitudes of maximum wind shear, which are also the altitudes of maximum turbulence. If little or no altitude choice is available or the jet stream is entered sooner than expected, try to cross it as near to a right angle as possible. Other than to slow down, there is really nothing else that can be done. Generally, it won't take too long to cut through it.
- If the wind parallels the flight path, a turn to either right or left should help, but a right turn is toward a more favorable wind component. Since zones are normally less than 4000 feet in vertical thickness, a climb or descent to the next flight level should place the aircraft in smoother air.
- If the temperature along the flight path is changing, climb if the temperature is rising, or descend if the temperature is falling. This will prevent flying up or down a sloping front or tropopause surface.

As the illustration shows, there are two areas of pronounced turbulence usually associated with a jet stream. One is along the tropopause just above the core of the jet stream, and the other is in the jet stream front which extends below the jet stream. Turbulence in these areas often extends along the tropopause and jet stream front.

TWA Flite Facts



If you must ford a jet stream, select an altitude above or below altitudes of maximum wind shear, which are also the altitudes of maximum turbulence.

A FEW GET BY

He was apprehensive, because of the weather and darkness, but did feel more at home than he had right after takeoff. Then he had had difficulty finding the ADF controls when departure control had asked that he maintain four thousand until past the Papa Whiskey Beacon. He had allowed himself to concentrate attention too long on one item, neglecting his cross-check and outside scan until those had come up, airspeed had dropped 30 knots, and the right wing was down. His instinctive reaction was a sudden over-correction, and he had criticized himself under his breath for it. Perhaps it had been a good lesson though; he had subsequently disciplined himself to think out each thing he did.

It had been dark for two hours now. For the past half-hour flight had been in clouds. The metallic scraping sound, varying in intensity, was due to sleet striking the aircraft. The autopilot was working and the CDI was almost in the center. He managed a wry smile as an old cliche came to mind—win a few, lose a few.

"Air Force 12345, Atlanta Center."

"Uh, Atlanta Center, Air Force 12345, over."

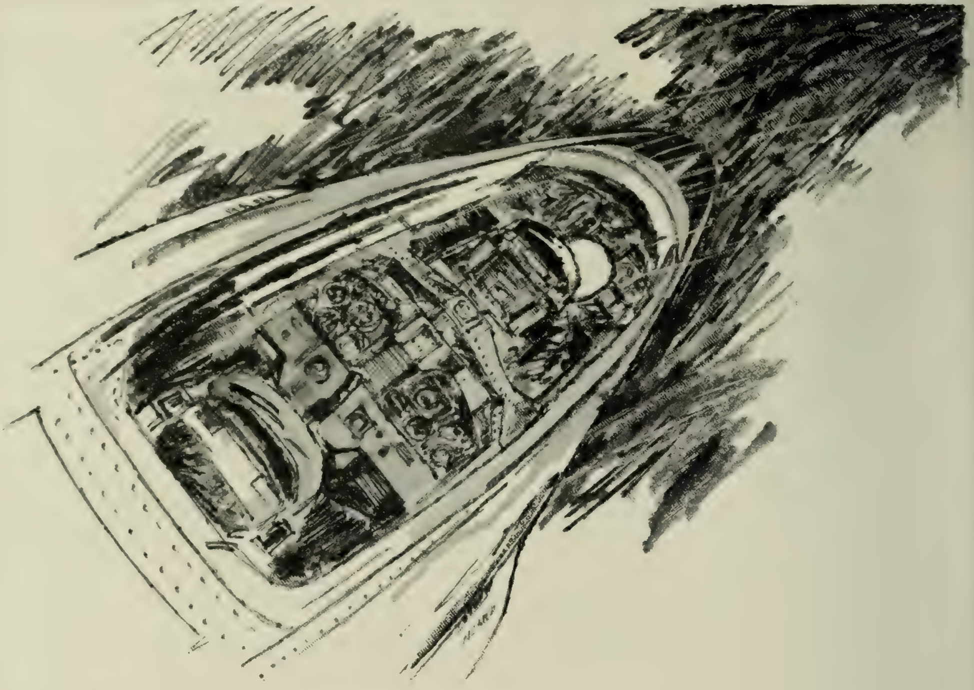
"Air Force 12345, would you like a radar enroute descent?"

"Uh, that will be O.K, Roger."

"Roger, Air Force 12345, continue heading one two zero, descend to one two thousand."

"Uh, Rog, Center, descend to twelve thousand."

He pulled back the throttle, pushed forward on the stick and rolled in nose down trim. He did these things automatically mostly. His brain was struggling with some-



A FEW GET BY continued

thing he had heard about these radar enroute descents . . . couldn't remember what it was.

He held his heading, pulled back slightly on the throttle as he noticed indicated airspeed had increased 20 knots. Things were settling down now. They had just caught him unawares—wasn't expecting descent for several minutes yet. Probably should have asked them to stand by—give himself a chance to get squared away—but he had pride.

"Air Force 12345, Atlanta Center. Have you started descent?"

"Rog, Center, descending now, Air Force 12345." He wondered why the call, then remembered that reporting leaving assigned altitudes is a mandatory report.

"Air Force 12345, Atlanta Center, say type of approach desired."

"Uh, Center, how about radar vector until below the clouds? Then I'll cancel and go in VFR."

"Air Force 12345, Atlanta Center. Be advised, weather is reported below VFR minimums; would you like a radar vector with a handoff to GCA?"

"Uh, Roger, that would be fine."

"Air Force 12345, contact Atlanta Approach Control on 381.6."

"Uh, Rog, going 381, uh, say again frequency."

"Air Force 12345, switch to 381.6, over."

"Uh, Rog, 381.6." He turned the rheostat up in order to see the numbers on the UHF control head. He fumbled a little, but set in 381.6.

"Air Force 12345, Atlanta Approach Control, turn left to one two zero, continue descent to one zero thousand, acknowledge."

"Uh, Roger, Cent . . . uh, Approach. Air Force 12345, I am heading . . ." How had he wandered over to 165 like that? "Turning to one twenty, descending to ten thousand."

"Roger, Air Force 12345. Say altitude."

"Uh, Cent . . . Approach, say again."

"Air Force 12345, Atlanta Approach, say altitude."

"Uh, fourteen point seven—fourteen thousand seven hundred."

At this point lost communications procedures were issued.

Descent was continued and the handoff made to GCA. GCA reported the weather, 800 overcast 2½ miles, wind 090 12 knots.

Descent was continued and, approaching 3000, another frequency change was issued. He had to ask for a repeat on this frequency as Approach's transmission was blocked by Guard. He switched from T/R & G to T/R.

No contact with GCA. He tried calling them. Still no contact. He wanted to go back to Approach. Couldn't remember the frequency. Should have jotted it down. It's in the book. Let's see . . . Atlanta, Atlanta . . . no, that's not right; it's under Dobbins. Funny, they should be calling on Guard. Oh, oh, turned that off. Back to T/R & G.

"If you read, proceed to Lost Mountain radio beacon and execute a standard ADF approach. Air Force 12345, proceed to Lost Mountain radio beacon and execute a standard ADF approach. Acknowledge."

"Atlanta App . . ." They're on Guard; they can't read. Gotta look up that approach control frequency. Oh, oh, two thousand feet. He added power and began to climb, checking the attitude indicator and leveling the wings. He brought the Enroute Supplement into his cross-check and, between glances at flight instruments, leafed through the pages until he found Dobbins. That was it, 381.6. He went to it.

"Uh, Atlanta Approach, Air Force 12345. Do you read? Over."

"Air Force 12345, Roger, read you loud and clear. Home on the Lost Mountain radio beacon and execute a standard ADF approach. Acknowledge."

"Uh, Rog, Atlanta. Understand you want me to home the uh, what mountain was that?"

"Lost Mountain. Air Force 12345. Home on the Lost Mountain radio beacon."

"Uh, Rog, Lost Mountain . . . uh, Cent . . . Approach, I'm having some radio trouble. Could you vector me to Lost Mountain?"

"Air Force 12345, Atlanta Approach Control. Reply code zero four, mode three, squawk emergency for radar identification."

Oh, Lord, where's that IFF control thing?

Finally he found it. No positive ID; finally though—after they asked him to verify normal power and he made a two detent change on the setting.

He was 28 miles east of Atlanta, 3700 feet. Approach turned him around. He pushed the stick forward and rogered when they asked if he were still at 3000. Then, as he got his dive established they instructed him to climb to 4000. He muttered something and pulled back on the stick. Trouble enough without Approach not knowing whether they wanted him to go up or down.

All at once he remembered something and, dexterously holding his pen-lite in his mouth while he flew with his left hand and rummaged through the FLIP packet with his right hand he came up with the Atlanta Terminal Chart. Sure enough, there was a Lost Mountain radio beacon. He tuned it in. It worked fine. The needle was on the nose.

He had a moment of inactivity and used it to salve his feelings with a little self pity at his misfortune. If all this had come up a month later he would have been much better prepared. His birthday was six weeks away and he always made it a habit to get in a couple hours of Link just before he took his instrument check. Always ran through one each of all the approaches too. And "good ole' Joe" had always passed him with the justification, "a little rusty in spots, but . . ."

Some of the pent-up tension had eased a little, and the bird was holding heading better. He lit a cigarette and let out a big sigh. For a moment he wondered if maybe he *really* should be in Category III. The value of a lot more study and practice never entered his mind. The way he figured it, the few times he would face an emergency in an aircraft didn't make a lot of study and practice worth the effort.

"Air Force 12345, Atlanta Approach. We have you two miles west of Lost Mountain radio beacon. Are you proceeding outbound for ADF Approach?"

Sure enough, Nr 1 needle has swung around on the tail—didn't remember when.

"Uh, Rog, I'm outbound. Uh, I'll call procedure turn."

"Roger, Air Force 12345."

Ground controllers were to blame really. If they hadn't offered him that Radar Vector-GCA thing he'd of had his approach plates ready. Let's see. Atlanta, Atlanta, Atlanta . . . no, it's under Dobbins. Ah, there it is. Oops, how'd the bird ever get in a bank like that. Oh, well, might just as well go on around . . . just home in on the Nr 1 needle.

"Uh, Atlanta Approach, Air Force 12345, procedure turn."

"Roger, Air Force 12345, call low station."

"Uh, Rog."

Oh, oh, looka there. Lights. Breaking out. Thank goodness. Man, there's not much terrain clearance out here. Gad, those are trees. Hope they don't have any TV towers out here. Let's see, 1550 indicated. Little low. Not at low station yet, but I'm not going to go back up into those clouds.

"Air Force 12345, Atlanta Approach Control. Radar contact lost. Say position."

"Uh, Approach, this is 45. Approaching low station. Starting to break out."

"Roger, Air Force 12345. Report station passage and field in sight."

"Uh," with their reminder he looked down and saw the needle swing. "Low station, now."

Holy mackeral, they sure don't give a guy much clearance out here.

A whisp of cloud blotted out lights below and he eased the stick foward. He looked at the approach plate and checked the heading to the field. He looked at his RMI and corrected back 20 degrees—the 15 he was off, plus five to account for the unknown distance he had flown off heading. Ought to average out—'bout due for a *good* break pretty soon.

Was that? It was!

"Field in sight, Atlanta, uh, this is Air Force 12345."

"Air Force 12345, Atlanta Approach, Roger. Change to Dobbins Tower, 236.6 for landing instructions."

"Rog. Uh, Goodnight!"

He made the change to Channel 1. Sure was a lot easier to maintain attitude visually.

"Uh, Dobbins Tower, Air Force 12345. Landing instructions, please."

"Air Force 12345, Dobbins Tower. Wind zero niner zero, 14 knots. You are cleared to land, straight in, runway one zero. Call gear down and locked."

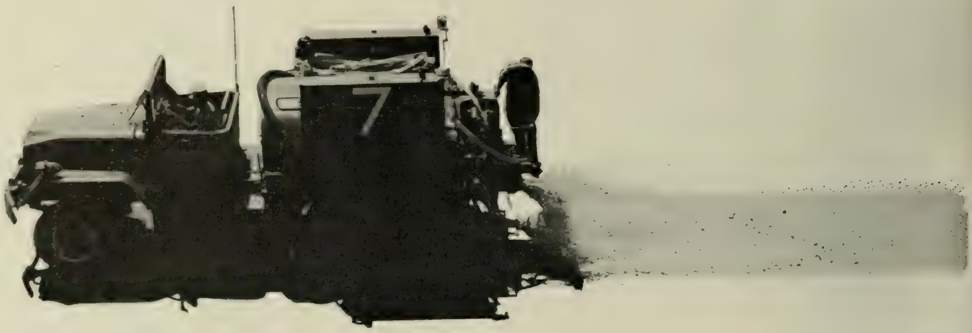
He shoved the gear handle down. That's right. Mustn't forget the gear. Would be terrible to forget the gear after all he had been through. He pulled back on the throttle and lined up with the left side of the runway. "Uh, gear down and locked. On final."

With the tower's help he got it parked.

It was quiet when the engine stopped. The fellow who put the chocks in called up. "Pretty nasty out there tonight, isn't it, sir?"

"Naw," he said. "After 20 years, a few clouds and a little rain don't mean much anymore."

. . . what're you gonna do? How do you ever motivate such pilots with the need for more study and practice? ☆



BLANKET OF SAFETY

T-37B At 1408 hours, Crash Control was alerted that a T-37B's left main gear would not come down. Crash trucks and crews responded to standby positions. The Flying Safety Officer requested that the runway be foamed. This was done.

The aircraft landed successfully with its left wing in the foam strip, sliding approximately a thousand feet.

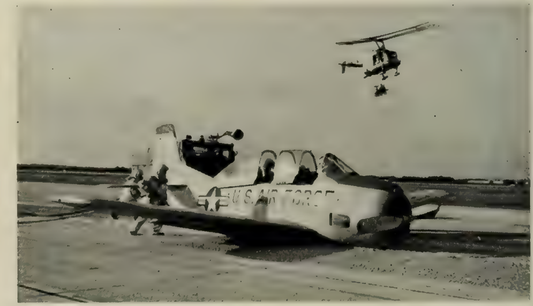
An HH-43B Helicopter received the alarm the same time that Crash Control was alerted and responded in two minutes. The helicopter followed the aircraft down the runway, taking the pictures shown on these pages. The foam was then removed with a Wayne Sweeper.

Here are some of the particulars of this incident:

- Nature of the emergency: A T-37B with main left gear in the UP position.
- Foam strip was 2500 feet long, 12 feet wide and two inches deep. This length was determined adequate to stop the aircraft, and the 12-foot width was ample for keeping the left wing and fuselage on the wet macadam surface for better skidding action.
- Method of application: A 1000-gallon water tanker with two 2½-inch Rockwood nozzles attached to pump piping. Both nozzles were used as shown in the picture of the tanker in operation.
- Quantity: 150 gallons of foam and 900 gallons of water were used for a total of 1050 gallons of liquid. Ratio of water/foam solution: 16 per cent.
- Pump pressure was 80 pounds, and nozzle pressure approximately 60.
- Foam blanket was applied in five minutes at a rate of 200 gallons per minute.
- The 94° temperature had little or no effect on the foam solution since the plane landed immediately after the runway was foamed.
- Had there been any trailing fuel the foam blanket would have minimized the fire hazard created by sparks from the metal contacting the runway. ☆

T-28

Another base, another time, another airplane—but again a foamed runway, helicopter and alert firemen make for a safe landing with minimum damage to Air Force equipment and limited risk to personnel.



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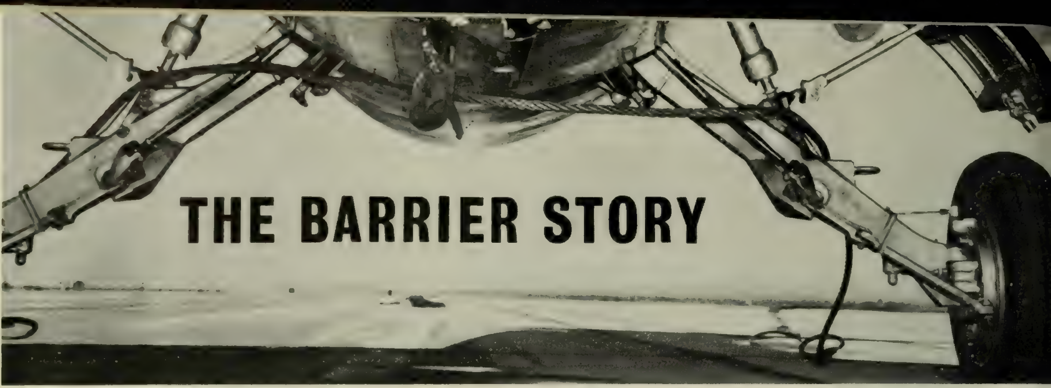
THE BARRIER STORY



Mr. Veryl V. Vary, Chief, Launching and Runway Equipment Br., ASD

This is a report on USAF aircraft arresting barriers, where we've been, where we are and where we are going with discussion of investment and profits.

In Figure 1 you see the Granddaddy of all USAF barriers. This is the first successful adaptation of the Navy's low net idea to the USAF overrun problem on land bases. This picture was taken in Japan during the Korean war. Pilots argued about her flying qualities but barrier people loved the F-84 because she was the best barrier engager the Air Force ever had.

The Aeronautical Systems Division developed a better net and a better chain distribution which yielded higher speed performance, polished up a few functional problems and called it the MA-1A shown in Figure 2. We bought and installed some 500 odd of these at a cost of around $6,000,000. In other words, they cost us about $10,000 per copy plus spares, new nets and so forth. Add to this whatever we had to pay for the roughly 50,000,000 pounds of chain we scrounged from the navies of the world. Each barrier used 91,000 pounds of chain to yield 12,000,000-foot pounds capacity. This is adequate for the T-33 but you'd need four to five times this much to give full protection for today's big fighters. On the other hand, if you hung that much chain on a T-Bird, you'd strip off the gear in the first hundred feet. We added the hook pendant at the start of the hook program. This gives about 96 per cent reliability with the century fighters.

Since we started keeping track in 1954, we've had a total of 2076 aircraft hit the MA-1A. The F-100 has been our favorite guest with the T-Bird holding a strong second place. The rest of the Air Force and some Navy fighters too have been good customers. It hasn't been all gravy but the barrier has caught 1289 of these birds, roughly 60 per cent. That 1099 that took minor damage contains the big profit. We can't put a dollar figure on it because, for one thing, we don't know how many would have been destroyed. I feel that 200 is a very conservative guess. Most of the 98 that took major damage would have been destroyed. The loss of the eight that were destroyed was caused by fire or obstructions such as drainage ditches. It is amazing what a pilot can live through so your guess is as good as mine on pilots saved. I think you will agree that our little plant has yielded a fair quantity of this premium by-product. The injuries shown are mostly face lacerations and back injuries due to those same drainage ditches. Most of the overruns are cleaned up now so we don't get many of these anymore.

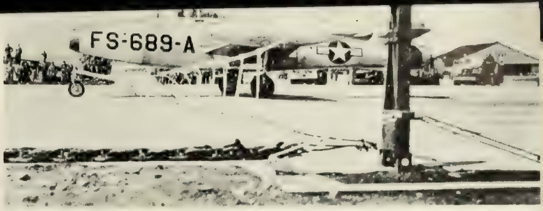
Roughly 40 per cent went through. Half of these didn't need help because they rolled to a stop without damage. Another 239 got their pants torn by the barrier. They didn't need help either because they also stopped in the overrun. The 80 that took major damage and the 34 that were destroyed are our big losses. Mostly high speed heavy weight, many of them just plain busted through and hit the ditches, fences, railroads and so forth. The amazing responses of pilots have kept the injury and death rate down. Not all have been lucky. A double death in a T-39 brought our grim total to 11. So even though our modest investment in the MA-1A has and will continue to yield a handsome profit, it falls far short of the total potential product.

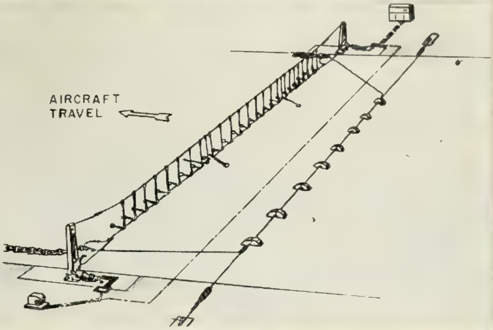
In 1959, Air Force Headquarters followed our oft repeated recommendation to buy hooks. It turned out that only the century fighters got hooks, leaving the T-33, T-38 and T-39 still depending solely on the MA-1A for protection.

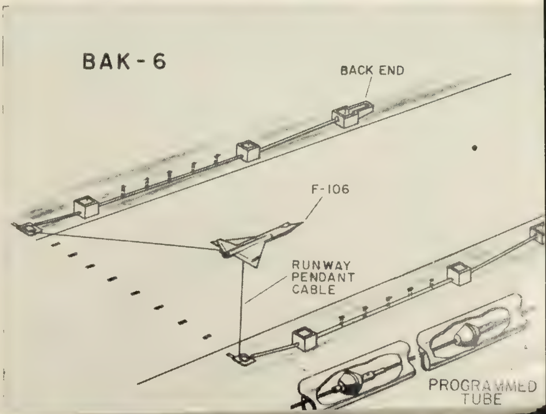
Air Force hooks are intended and designed for emergency arrestment only. The pilot cannot retract the hook as is done on Navy fighters. Since we have more room in which to work, we do not require the strength that is built into a Navy hook and the weight can be held down accordingly. Air Force hooks are of two general types. First is the conventional, stiff shanked hook with air oil dampers which we commonly call the Navy type hook shown in Figure 3. This is used on the F-102, F-104 and F-105. The second is the patented Shaefer spring hook developed by the All American Engineering Company. This consists of a long flat spring attached at the fuselage by a vertical pivot bolt. At the free end of the spring is a Navy hook shoe. A picture of a spring hook is presented in Figure 4. We use the spring hook on the F-100, F-101 and F-106. Both hook types work equally well and we have had no serious problems with either in our widespread use.

At the start of the hook program, we ordered from All American Engineering Company, 50 of the water

Figures 1 through 5, top to bottom: USAF's first barrier was used in Korea; improved, it became the MA-1A; shanked hook with air oil dampers used on F-102, F-104, F-105. F-106 with spring hook after engaging BAK-6; diagram illustrates water squeezer principle.







squeezer energy absorbers shown in Figure 5. We call it the BAK-6. These were installed at 25 Air Defense Command Bases to protect the F-106. It was an outgrowth of one of our development programs and was the best available at that time. With 50,000,000 foot pounds capacity, it does a good job on the heavy fighters while handling the light ones gently enough to avoid bending. These units cost us $70,000 a copy installed. A total of $3,500,000. While the cost of arrestment went up, the value of the product has been going up. So far we have had 50 engagements with 23 being F-106s. If we assume that the average saving per engagement was $70,000, then the plant is paid for and all saves for the next ten years or so are almost pure profit.

This is rugged equipment which will give many years of good service. However, it has some serious disadvantages when compared with later equipment. Once you plant this thing it is there to stay because it costs more to dig it up than to build a new one. It has a limit engaging speed of 160 knots which isn't fast enough and we will probably lose at least one heavy hot bird because of this. It is slow to retrieve and if you break a retrieve rope, you've got an all day job. The arresting pendant is on the active runway because the BAK-6 must have 1500 feet to do the job. This causes trouble on the approach end as attested by two very surprised F-106 pilots. Imagine setting down nicely in that tail down semi-pogostick landing attitude of the F-106 then suddenly you are hanging on your shoulder straps with your eyes bugging out in a two G arrestment. Convair ginned up a guard to keep the cable out of the stowed hook. A couple of C-133s have had their low hanging pants torn by the pendant. Air Defense Command complains about this. The excellent all weather pneumatic retractable cable support system we call the BAK-10 would solve their problem. It would cost about $10,000 per site or about $500,000 for all 50.

The machine we call the BAK-9 was developed by the E. W. Bliss Company and thoroughly tested by the Navy and the Air Force jointly. The BAK-9 costs less than the BAK-6. It does the job in 1000 feet. The upper speed limit is 190 knots and it is actually gentler on the light birds. An electric motor retrieves the system after arrestment in five minutes. The machine is easy to trouble shoot and maintain. It comes in a neat package you can stick in a pit at the runway edge. The pits are built so you can lift the lid and add a second machine to double the capacity if needed. Because the lid must be able to take 100,000 pound wheel loads, that pit is a real blast shelter. In fiscal '61, we ordered 110 of these at $25,000 per copy. In fiscal '62 we ordered 76 more. So far we have about 70 installed, mostly in our NATO bases. Installations are averaging about

Fig 6 is schematic of new BAK-12, rotary friction system; Fig 7 shows Van Zelm metal bender, novel approach to arrestment; Fig 8 nylon tape on Navy water twister; Fig 9 illustrates BAK-9 and BAK-11 teamed up to catch all type aircraft including bombers.

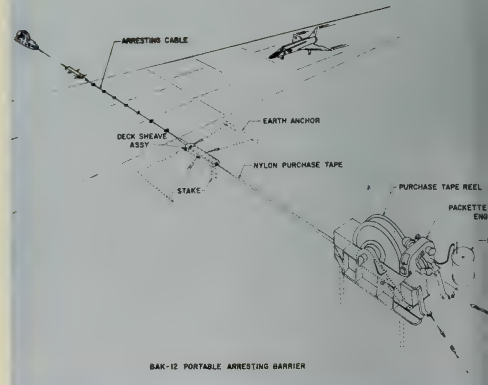


Fig 6

continued

THE BARRIER STORY

$37,000 each. This includes bringing three phase power to the site. So far we have had 65 recoveries. Again the F-100 is our favorite guest at 30 and the F-102 holding second place at 24. If we again assume an average saving of $70,000 per engagement, then these 70 BAK-9s have paid for themselves and are now working on the bill for those we have on order.

Before I leave the subject of energy absorbers, there are several energy absorbers which have been developed and tested which deserve mention.

The E. W. Bliss Company has developed a rotary friction system similar to the BAK-9 except that two separate identical units are placed symmetrically, one on each side of the runway. The Navy has tested this thoroughly as the M-20. It is a very sound approach. The Air Force has ordered four pairs with performance equal to the BAK-9. The equipment is to be expeditionary with installation to be on top of the ground like the M-20. A schematic drawing of this equipment which the Air Force will call the BAK-12 is presented in Figure 6.

A very novel approach to the arresting energy absorber is the Van Zelm metal bender shown in Figure 7. This equipment stores a long strip of mild steel strap in a unique low inertia reel. The strap feeds out of the reel through a series of rollers which bend it beyond the yield point several times thus absorbing the energy. The Navy and Air Force jointly tested the metal bender and found it to be a sound approach. It has excellent high speed capacity and the retarding load is very smooth and predictable.

The metal bender is a constant force machine. The retarding force can be preselected by use of an adjustable stop on the torture chamber jaws, thus accommodating aircraft of various weights and strengths. The straps are discarded after an arrestment and resetting is slow. The initial cost is attractively low compared to that of other systems. The Air Force anticipates use of the metal bender at locations where the above limitations are not a problem and frequent use is not expected.

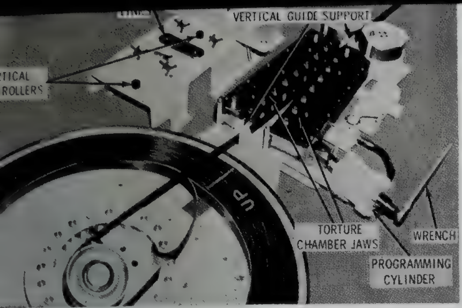
The All American Engineering Company has developed a new approach which they call the water twister. Nylon tape is reeled on a drum in a manner similar to that of the BAK-12 except that the reel is horizontal. The reel shaft drives a paddle wheel in a tub of water, very simple and effective. Because of the decreasing effective drum diameter as the tape pays out, the paddle wheel is driven at essentially constant speed as the aircraft decelerates. The Navy has reported that their M-24, which is a water twister, has yielded very satisfactory performance. This equipment in expeditionary form is shown in Figure 8.

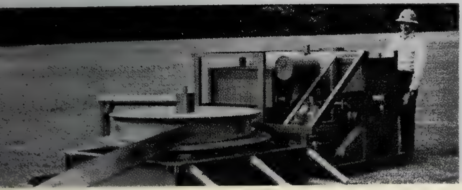
Vortec, a subsidiary of Douglas Aircraft Company, also offers a rotary hydraulic energy absorber with nylon tape reels. The hydraulic energy absorber is somewhat more sophisticated in concept than the paddle wheel and tub approach. To date, insufficient test data exist to allow an evaluation to be made.

In 1958 when it was decided that hooks would not be placed on bombers and tankers, we scraped up some funds and contracted with Research Incorporated to develop a cable thrower to get ahold of the main landing gear. The effort has been completely successful resulting in the BAK-11 engaging device. We commonly call it "The Pop-Up." Switch mats connected to a simple electronic timing system sense the position and speed of the aircraft. The cable lies in a slot across the runway. At the correct time, high pressure air is admitted to the slot under the cable and the cable is thrown vertically to intercept the main landing gear struts. The system can also be set to fire behind the main wheels and engage a hook.

With two BAK-9s and a BAK-11 teamed in the manner shown in Figure 9, we can catch and safely arrest all fighters and jet trainers and all bombers and tankers at energies up to 100,000,000-foot pounds. We can do the same for the commercial jet fleet and most of the propeller driven commercial fleet and will guarantee that the propellers will not be touched. We have yet to prove this with bombers, tankers and cargo craft. So far we haven't been able to get an airplane. We are now ready and standing in line for a B-58. It is a matter of waiting for a test bird to get tired enough to be grounded. We consider this phase of tests to be important, not because we don't know what the system will do, but because we must demonstrate this to the potential users so that they will buy with complete confidence.

The Aeronautical Systems Division considers the ar-





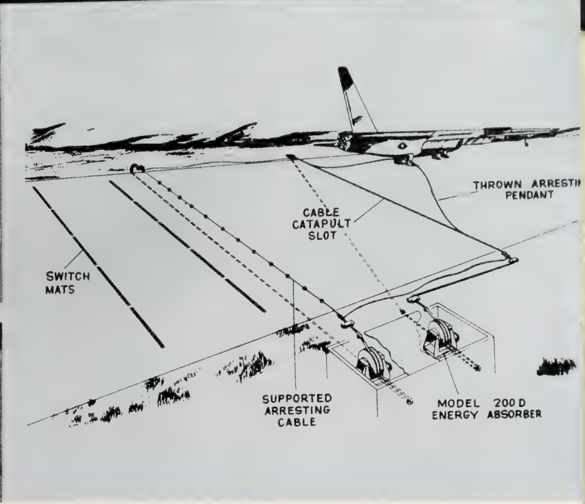


Fig 7 top **Fig 8 bottom**

Fig 9

resting barrier technology to be well developed. If, for example, USAF wanted an arresting barrier that would take the B-52 at takeoff speed at maximum weight and arrest it without exceeding any reasonable arbitrary maximum retarding load, this would require an energy absorber of 500,000,000-foot pounds capacity which is ten times that of the BAK-9. We would have the procurement data ready within two months. We would expect to get firm fixed price proposals with guaranteed performance from at least two of the five well qualified competitors. We would confidently expect completely acceptable equipment to be installed at the site ready for acceptance tests within 12 months of the contract date. We would use some reasonable selection of existing airplanes to verify the performance curves. Incidentally, we would also expect the machine just described to do a good job on other airplanes ranging in weight from 50,000 pounds upward.

We don't care how heavy, fast or fragile the bird is. The state of the art is now at the point where you can give the knowledgeable competitors the numbers and a reasonable amount of room to work in and they can give you equipment that will stop your bird without bending it. It is the official position of the Aeronautical Systems Division that development of fixed base aircraft arresting barrier technology is essentially complete. All future efforts in this area will be toward reduction of cost and upgrading the hardware we have in hand.

The resounding success of the Air Force fighter barrier program demonstrates that modest investments in such equipment are highly profitable. It is conceded that equipment for heavier birds will naturally cost more but the value of the airplanes is also greater, to say nothing of the value of that very premium by-product, human lives. What is needed now is action on the part of the board spectrum of potential users, both military and civil, to implement positive programs to procure the equipment which can now be obtained so that we may soon begin to approach 100 per cent of the potential product of aircraft arresting barriers. ☆

Hit 'Em Anywhere

Safety publications have repeatedly been guilty of advocating a very dangerous maneuver which is absolutely unnecessary. The exhortation "Steer toward the center of the runway if possible" is typical. Several variations and elaborations on this theme have been published in the past. There are several well documented cases in the files of barrier contract reports in which pilots, believing this maneuver necessary, attempted it and lost directional control and completely missed the barrier or caused an engagement failure by an angling approach. Several of these airplanes were destroyed and pilots injured all because of this reasonable appearing but completely false notion. The simple brutal truth is that within the speed range of anything short of a "fly on" engagement, the BAK-9 couldn't care less whether you are on center or clear over next to the deck sheave.

Even with the older MA-1A and BAK-6, barriers, if you have time to even think about "steer toward the center of the runway if possible," your speed at contact will be within easy off center tolerance of these barriers.

Airplanes are not built for ground maneuvering. Anyone who ever rode a tricycle at any speed knows it is unstable when you go around a corner. So why try to steer this high speed, very awkward tricycle around corners when such maneuvering serves not the least useful purpose?

An approach end engagement is a different matter. In this case you need the full speed capability of the barrier. You should line up on center as you roll out on final and stay on center as you descend to touchdown and engagement. In this case there is plenty of time and the airplane maneuvers in its natural environment. If you drift off at the last minute, you can go around the same as on a bad landing approach. But for safety's sake don't try to maneuver after you are on the deck because this can be deadly.

Last year 236 Air Force aircraft, headed for trouble off the end of a runway, were saved by barriers, proving the value of equipment that can . . .

CATCH'EM-SAVE'EM

The headline above testifies to the value of barriers to the Air Force accident prevention program. Possible, and in many cases certain damage was prevented thanks to these bands of nylon webbing stretched across Air Force runways. The 1962 engagements represent an 84 per cent success rate, a notable increase in the reliability rate of 66 per cent during the previous year.

One modification must be credited—tail hook equipped aircraft. Tail hook engagements were 98 per cent successful; in fact, the six tail hook engagements made inadvertently on the approach end were successful insofar as stopping the aircraft. All were stopped, but in two cases the nose gear failed. This is most likely to occur when engagement is made in a nose high attitude. Installation of the tail hook light is expected to minimize such inadvertent engagements. (However, as one pilot proved, it's possible to engage the cable with the hook stowed—provided you land with the nose high enough.)

All told there were 287 arresting barrier contacts. In the case of non tail hook equipped aircraft going into MA-1A barriers the success rate remained at between 60 and 70 per cent.

Of the 45 unsuccessful engagements, 30 were due to too slow a speed—again pointing up the design deficiency of the MA-1A barrier which requires a minimum airspeed for engagement of the main landing gear.

Optimum success was achieved with BAK-6 and BAK-9 installations and tail hook equipped aircraft. (A BAK-12 barrier, offering even greater reliability potential, has been tested at Edwards AFB.)

Materiel failure accounted for over 60 per cent of all barrier contacts. Of these, the predominant cause was drag chute failures—failure to deploy, inadvertent jettisoning and failure of the chute to open properly.

Although barrier contact reports do not require explanation of drag chute failure causes, it has been suggested that more adequate packing procedures and better inspection of drag chute installations would improve the situation. Weak brakes and hydraulic system failures were reported numerous times as the cause for barrier contact. The combination of drag chute-brake malfunctions were involved in 132 of the cases.

In 58 of the cases, pilots brought on the engagements themselves through poor technique—landing too fast, or too far down the runway and errors in aircraft systems operation.

Two of the unsuccessful engagements were attributed to pilots failing to raise speed brakes prior to contact with the MA-1A barrier. ☆

CAUSES OF UNSUCCESSFUL ENGAGEMENTS

Aircraft Speed Too Slow	30
Speed Brakes Deflected Cable	2
Landing Gear Retracted	2
Barrier Maintenance	2
Arresting Cable Failed (MA-1A)	2
Reverse Engagement	2
External Stores Deflected Cable	1
Other (1 BAK-9 improperly serviced)	4
	45

TYPE BARRIER

	Successful	Unsuccessful	Per cent
MA-1 (Unmodified)	87	43	66.9
MA-1 (Modified, hook used)	27	0	100.0
BAK-6	57	1	98.2
BAK-9	71	1	98.6

CENTURY SERIES FIGHTERS VS OTHER AIRCRAFT

	Successful	Unsuccessful	Total
Century Series	199	19	218
Other Aircraft	43	26	69
	242	45	287

CAUSES OF BARRIER CONTACTS

MATERIEL	
Drag Chute System Failures	72
Brake System Failures	43
Brakes and Drag Chutes (Failed Jointly)	17
Engine Failures (Inducing Aborts)	29
Tire and Gear Malfunctions	9
Flight Control Failures	6
Other Materiel Failures	9
	185
PERSONNEL	
Pilot—Poor Landing Technique	58
Intentional Engagements (To prevent tire damage)	7
Jettisoned Drag Chute in X-Wind Landing	8
	73
AIRFIELD CONDITIONS	
Wet and Slippery Runways	29
TOTAL:	287

MISSILANEA

CALIBRATION PROGRAM. A Calibration Program Information Letter of interest to AMA and base Precision Measurement Equipment Laboratories (PMEL) personnel is being published by the 2802d Inertial Guidance and Calibration Group (MAAMA). Several articles appearing in this letter would be of interest to quality control personnel assigned to missile organizations. Recommend a copy of this letter be obtained from the local base PMEL. For further information contact the 2802d Inertial Guidance and Calibration Group (MAAMA), Newark Air Force Station, Newark, Ohio (MAHL).

HEAVY HANDED SUPERVISION. When you as a supervisor feel that your instructions, safety briefings, and tech data are adequate for every eventuality —BEWARE—something new may rear its ugly head. Result: Personnel injury or equipment damage.

A film was being made for use in the audio-visual training program and photographs of a vernier engine were required. A photographer and airman helper went to a complex, checked in with the combat crew commander, received a safety briefing and permission to go into the silo. The photographer and airman helper went down to Level 6, opened the door, lowered the work platforms, and set up their camera equipment. The airman accompanying the photographer felt that some people viewing the film might not know a vernier engine if they saw one and that possibly his presence in the picture might improve it. So, he leaned against the LOX tank pressurization duct and pointed to the Nr 1 vernier engine as the picture was taken. Later, it was discovered that "old heavy hands" had put dents in the duct that were beyond allowable limits. The bird had to come off ALERT to be repaired.

Supervision cannot become routine. Supervisors must always be on the alert. Many things that are not covered in the tech data or in the standard safety briefings occur frequently. If the supervisor isn't on his toes, someone will get hurt or equipment will be damaged.

Maj Curtis N. Mozley, Directorate of Aerospace Safety

TITAN TOPICS. *"Oops"—it could be a long first step!*

Recently, an individual working in a Titan II silo almost took that proverbial *long first step.* He opened the elevator door and started to step in. Fortunately for him, he looked inside where the elevator should have been and noticed an odd looking vacant space with *no* floor! When he peeked over the side into the elevator shaft, he noted that the elevator was in fact many floors below.

We know that an interlock mechanism is incorporated in the system that should prevent this type of malfunction. But—inspection of this interlock mechanism revealed that it was out of adjustment. Apparently a gradual maladjustment resulted from continual slamming of the door.

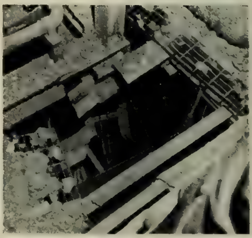
A check was made of all elevator doors on the complexes and several were found almost out of tolerance. Simple adjustments were made where needed, which corrected the situation.

The unit recommended that signs be posted on all elevator doors to "CAUTION" against rough handling. Signs may be posted warning personnel to "LOOK" before entering. But, the fellow who almost took the "long" step won't be needing a sign to remind him that it's a long way down to the bottom of a silo.

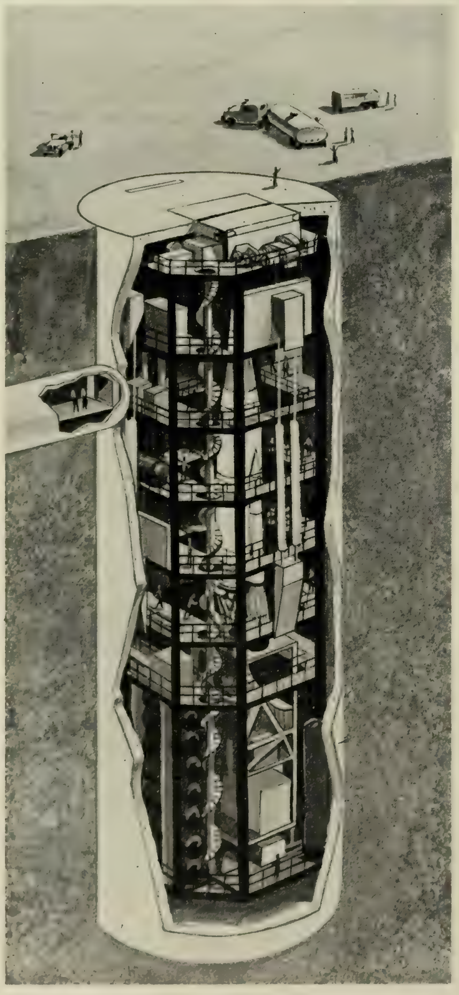
Suggest Missile Safety Officer of units with elevators in their silos investigate to see if a similar hazard exists in their own backyard. ☆

Lt Col Driskill B. Horton
Directorate of Aerospace Safety

Needle in a SILO



CONCLUSION



LAST MONTH: In part one of* Needle In A Silo *the Aerospace Safety Accident Investigation Board (ASAIB) for the Atlas convened at the request of the major command to investigate an explosion that wrecked a missile and turned its silo into a chamber of horrors reminiscent of a Hollywood set for a science fiction movie. Quickly the Board assembled at the site and began the long, tedious investigation that eventually found the needle in the silo that was suspected as being responsible for the catastrophe. In the concluding half of this article the author completes his description of the investigation.

ALL PHASES OF INVESTIGATIVE ACTIVITY except for the hardware and systems examinations within the silo continued vigorously. A group of investigators who had been working within the silo were sent to examine an operational site for possible fire sources and to verify locations of explosive components. By this time review of standardization board records was completed and it was verified that the crewmembers were qualified in accordance with major air command requirements.

On the sixth day additional personnel from the Directorate of Aerospace Safety joined the ASAIB to assist in hardware failure analysis. The RP-1/LOX explosive expert arrived for evaluation of the explosive forces. The development agency sent two engineers from contractor sources to advise the board on LOX gel behavior characteristics. A telephone call was received from the major air command safety and maintenance personnel stating that immediate action was being taken on recommendations of the board concerning GOX detectors, personnel escape and emergency equipment, and housecleaning requirements of the silo area. The rest of the recommendations were being considered. Based on observations at the accident site and other sites the board recommended to the development agency that an evaluation be made of the location of fire detector units in the diesel engine generator areas on levels 5 and 6.

On the seventh day an evaluation of the immediate hazards involved in site re-entry for investigative purposes was conducted by board members and cryogenic materials advisors. Examination of condition changes by the hazard team indicated increased LOX flow from the damaged LOX storage tank line and an increased flow of ground water through the spalled concrete silo wall area. Air sampling showed 25 per cent oxygen content at level 5, 21 per cent at level 6 and approximately 16 per cent at level 8. Continued integrity of the crib structure was questioned.

To complete the evaluation of hazards involved in silo re-entry, for continuation of that phase of the investigation, the development agency was requested to provide for a silo structure examination by qualified engineers. This action was taken to determine whether continued controlled investigation activity would cause collapse of the crib structure.

The board president briefed the major air command vice commander-in-chief on progress of the investigation and recommendations. A tape library with footage logs was established to facilitate review of witness testimony and special reports. Maintenance records pertinent to the investigation were indexed for use while the evaluation and analysis effort was still in progress. Excessive time was required by the maintenance, inspection and records group to locate missing maintenance forms and to correlate squadron and "Long Reach" team records. The group leader compared the effort to that of a Chinese bank audit.

A file of EURs, AF Forms 1395, and missile hazard reports was provided to the board by the major air command safety office.

On the eighth day, two engineers arrived from the architectural engineering corporation that had designed the site to advise the board on the structural condition of the silo. Evaluation of the hazards to continuation of investigative activities was accomplished by the board and advisors. Cryogenics specialists' evaluation of hazard team observations indicated that liquid oxygen was still present in the silo and liquid nitrogen was also present in at least one storage vessel. Content of the high pressure gas storage bottles was unknown. There was a dangerously low oxygen level in the lower portion of the silo. Considerable quantitites of material that was thought to be both impact sensitive and combustible were still in the silo. Water seepage into the silo was continuing at an increasing rate. I-Beam fractures in the vicinity of the L-15 filter had resulted from cryogenic temperature embrittlement. Gaseous oxygen detectors were inoperative.

A major fire apparently existed in the silo outside the missile enclosure area prior to the major explosion. The fire did not penetrate the missile enclosure area until just prior to the major explosion. Because of the serious risk to the lives of the persons making the entry the advisors recommended that no further entry be permitted into the silo. Their advice was based on the following hazards: crib structure integrity was questionable. Silo structural integrity was questionable. An oxygen deficiency existed at the lower levels of the silo, even though liquid oxygen was present in the facility and generating gaseous oxygen. There was a danger of combustible and impact sensitive material in the silo. The high pressure gas bottles may not have been vented. There was considerable falling debris from the various levels.

The observations, conclusions, and recommendations of the advisors from the architectural engineering corporation were: there was severe spalling of the concrete, particularly on the underside of the silo cap and the walls on the south side around the southerly shock hangar wall bracket and the southeast quadrant down

to level 7. The structural members of the crib were not damaged except that columns C and D were severely distorted at levels 3 and 2, the penthouse beams on the north and south sides were severely distorted, the counterweight hand guide rail was distorted and torn loose from its support, the principal member on level 3 between the launch platform area and the counterweight area was distorted and torn loose from its connection on the south end, counterweight cables were broken and the counterweight had fallen to the bottom of the silo, secondary members supporting heavy equipment on various levels were extremely deflected, shock struts were fully extended and the springs had bottomed on the south and west sides. The silo walls had failed due to spalling caused by prolonged exposure to fire and high temperature rather than blast forces. No further collapse of the walls or cap was anticipated since ring beam supports carry earth loading.

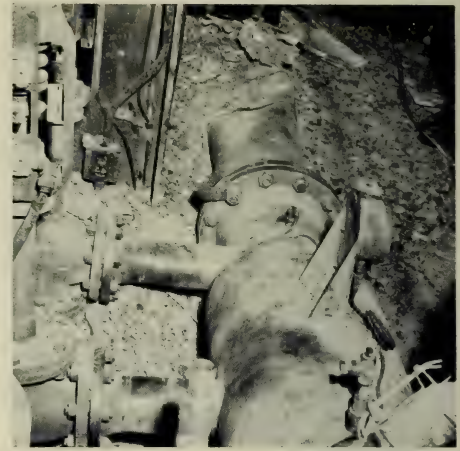
From a structural standpoint only, it was determined that there was no undue hazard under controlled conditions for limited personnel access to the silo. The water level should not be permitted to rise above the floor of level 8. Heavy equipment should not be permitted on the cap. Should shifting of the crib occur, the silo should be evacuated.

By the tenth day the advisors had completed their hazard evaluations and submitted their reports to the board. Cryogenics personnel felt that by this time the LOX gel hazard no longer existed. The remaining unacceptable hazard to resuming the investigation was the unvented high pressure gas vessels. Board members and advisors concentrated their efforts on determining whether the high pressure gas vessels actually contained gases under pressure. The hazard team and the chemical engineer advising the board re-entered the silo to determine whether the vessels were still charged and whether valves in the system could be operated to release such pressure. Their evaluation confirmed that as much as 6000 psi gas pressure could still be in the system and that there was no practical way of operating any valves in the systems to relieve those pressures.

The EOD specialist from the local munitions maintenance squadron briefed the board on the merits of thermite grenades for cutting the heavy duty stainless steel lines and shaped charges for piercing the lines. He conducted tests on sample pieces of the lines involved and discovered that a MARK II shaped charge with two ounces of composition C4 would drill a 1/4 inch hole completely through the diameter of even the 1/2 inch wall thickness line. Air munitions personnel supplied the board with empirical formulas for determining the overpressures that could be expected from two ounces of composition C4. There were five lines that required piercing. Overpressures were calculated and checked with the explosives expert advising the board.

It was decided that two setups would be used, one group of two charges and another for the three remaining lines. The EOD specialist volunteered to set the charges and the line piercing operation was completely successful with the first grouping. In the second grouping, however, one of the charges slipped slightly gouging out the side of the line without piercing the wall.

The board recessed for two days to allow adequate venting of the helium and gaseous nitrogen vessels. Upon re-examination it was discovered that the line which had not been pierced had been weakened sufficiently to rupture and exhaust the vessel during the waiting period.



LOX transfer control prefab received careful scrutiny.

Full scale controlled activity was resumed on the investigation of the systems and hardware remaining in the silo. Analysis groups were established and detailed questions were presented to the missile structure and subsystems group to insure complete coverage of questionable components and systems. The explosives expert had completed his explosive forces analysis and presented a preliminary report to the board. Structures above ground exhibited no evidence of overpressure damage. Lack of evidence of lateral deformation of the cooling tower structure and the undamaged glass windows in the utility building showed that overpressures as close as 110 feet from the center of the silo cap were below 1/2 psi. The silo cap doors, however, were blown off and were lying 100-110 feet from their original position. Structural deformations within the silo were generally downward from level 5 and below, while from level 4 and above they were upward in nature. The approximate location of the main explosion was in the area of the intermediate bulkhead.

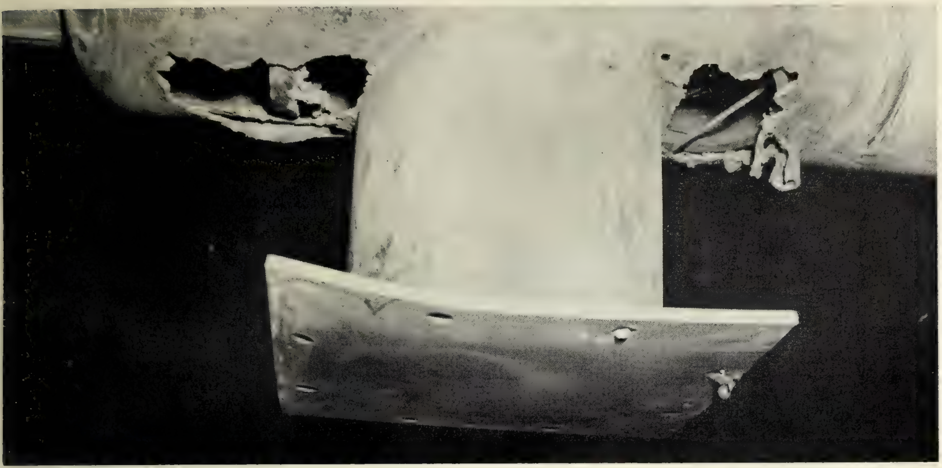
The sequence of events within the silo from a blast point of view were:

1. A GOX rich atmosphere probably existed within the silo for some time during the drain sequence.

2. During the abort mode, after approximately 20 minutes of LOX downloading, fire was observed on TV monitors and indicated by the fire alarm system. Not more than 1500-2000 gallons of LOX remained on board the missile.

3. Shortly thereafter, the LOX tank pressure went to zero and the major explosion occurred, blowing the silo cap doors off and venting the explosion to the atmosphere.

4. The explosion was followed by a fuel fire lasting for approximately 19½ hours.

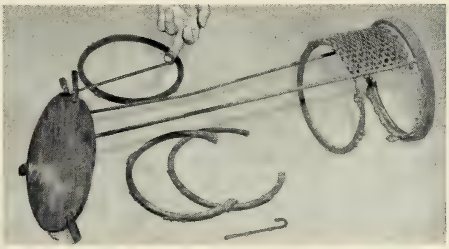


Large holes in LOX filter housing resulted from an internal oxygen-steel fire during missile downloading cycle.

The explosives expert stated that lower yield detonations occur both above ground and in-silo if mixing is minimized before ignition and if a positive ignition source is present at the time of mixing of the fuel and oxidizer. In this accident both of these conditions were present. The mixing interface occurred through a rupture in the intermediate bulkhead. A mass spill of fuel and oxidizer did not occur. The early ignition source was present in the form of a fire in the GOX rich atmosphere. It was concluded that a massive oxygen rich deflagration occurred within the silo.

The search was painstaking and time consuming. The rubble was sifted and pawed and scraped away from components and whole systems. Gradually components then subsystems were exonerated as possible cause factors. The pod air conditioner, a prime suspect from the start of the investigation, was given a clean bill of health. The electrical power production system was finally exonerated. The LOX transfer system was receiving careful scrutiny when one of the investigators started pawing the spall away from the L-15 filter on the LOX prefab. Feeling around underneath the filter housing, he found a large hole adjacent to the mounting pedestal. Careful removal and examination of the L-15 filter revealed three large burned-through areas, one on either side of the mounting pedestal and one into the pedestal area which did not penetrate the butt plate. The unit was removed from the silo for failure analysis.

The holes in the filter housing were the result of an internal oxygen/steel fire originating in the filter mesh and burning through the filter housing during the downloading cycle. There was evidence of LOX flow during the fire both through the L-16 valve and through the burned hole areas. LOX flow through the holes in the filter housing caused the cryogenic failures of the steel beams observed in the vicinity of the L-15 filter. Examination of the filter element J-bolts revealed a cold bend in one of the bolts at the end plate. Evaluation of this failure indicated that sufficient force had been exerted on this J-bolt to bend it approximately 90 degrees prior to the occurrence of the fire within the housing.



Filter J-bolts failed from unknown force prior to fire.

The specific cause for the ignition of the oxygen/steel fire within the filter housing could not be determined. Additional advisors with experience concerning oxygen/steel fires examined the evidence available; however, it could not be positively established whether an impact sensitive contaminant or mechanical action of the filter element provided the heat source to start the fire.

After sifting the mass of evidence gathered during the investigation, the board spent many long hours putting it all together in logical sequence in order to read the story it told. The board's report contained 26 conclusions, seven findings and 16 recommendations. Valuable lessors learned from this accident are being passed on to each F series squadron in presentations and cleanliness inspection procedures briefings. ☆

Aerobits

CALL TWO LUCKY—Mission was a functional test flight in the T-Bird after periodic. The pilot assigned to fly the mission received clearance from the tower, taxied into takeoff position and advanced power. As the RPM increased he noticed a red light come on —generator warning light. He chopped the power, reported his difficulty and taxied back to the line.

Repairs were made, the airplane checked out by maintenance, and again scheduled for a functional test flight. Another pilot was assigned to fly the mission. He too received clearance for takeoff, lined up, shoved the throttle forward and checked power. O.K. He released brakes and the T-Bird was rolling. After start of takeoff roll he noticed the tailpipe temperature fluctuating. He aborted, taxied back in and wrote up the discrepancy on the '781.

Again repairs were made. Maintenance ran up the engine. Tailpipe temperature steady, in limits. For the third time it was scheduled for a functional test flight.

A third pilot was assigned the mission. He picked up his gear, filed and went out to the bird. He went through the normal preflight checks and, as was his custom, checked controls for free movement and proper direction of travel of control surfaces.

The ailerons were hooked up in reverse!

We don't know the names of the first two pilots, but "Lucky" will do.

AN ACCIDENT WAS CREATED—Two highly qualified B-47 crews planned and briefed a mission that was to include refueling with a KC-135, day celestial navigation and low level activity. The crews were briefed to fly a loose visual formation during the day celestial navigation leg en route to the refueling area. MARSA was entered on the Form 175 at base operations, indicating that the pilots were aware of the hazard associated with being at the same altitude, going the same direction, to the same termination point, at the same airspeed. This would also mean that their navigators' and copilots' attention would be directed to accomplishing the celestial navigation, while the pilots' primary attention was to keep their aircraft clear of each other for collision avoidance.

Not long after the start of the celestial leg, the aircraft appeared to be converging—with the number two aircraft overtaking the leader. (At this point the writer must surmise that both crews were so engrossed in their crew duties that they were not aware of their close proximity or that they did not consider it "too close for comfort.")

Just before the collision, the copilot of one aircraft called out that they were converging. The pilot disconnected the autopilot and attempted evasive action but to no avail. The aerodynamic disturbance of the higher aircraft had already been induced on the lower aircraft and the accident was assured. The warning on page 6-14 of the B-47 Flight Manual again proved valid—an accident was created.

Since both copilots were using their sextants for celestial observations, they had removed their parachutes and their survival gear. Both were killed. The body of one copilot was finally located a considerable distance from the aircraft wreckage. One navigator was apparently unfamiliar with his ejection system and manually bailed out through a gaping hole in the fuselage. One aircraft commander apparently waited too long and was killed during a low altitude ejection.

When two bombers are scheduled to fly the same route at the same altitude and airspeed at the same time with multitudinous crew requirements, there is a strong likelihood that sooner or later they will collide unless extreme care is exercised to prevent the collision.

Every individual assigned to a combat crew should devote his full duty time to learning every "trick of his trade." An intimate knowledge of his flight manual will enable him to perform his job with ease and at the same time adequately prepare him to react to any emergency, as would be expected of a professional crew member.

Lt Col David J. Schmidt, Directorate of Aerospace Safety

PILOT MASHER—T-BIRD STYLE. The bug with skull and crossbones on the cover of the September issue of AEROSPACE SAFETY is indeed a grim reminder of the many pilots presently residing in the aviator's Valhalla; and of the many shattered flying machines trundled to the bone yard because of foreign objects.

A recent T-Bird incident points up a real hairy one. When the IP lowered his seat the seat belt and man-seat separator fired. He was thrown up against the canopy and forward in the cockpit. His body exerted pressure against the stick until he unsheathed his knife and cut the snapper.

Post landing investigation disclosed a locally manufactured let-down book holder under the seat. The book holder bent when the seat was lowered on it and pushed against the cable assembly (P/N NAS 324C22-0123). The force exerted against the cable assembly caused the M-32 initiator to fire.

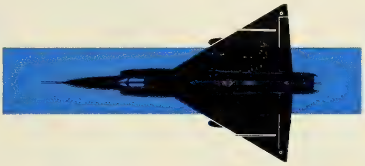
Fortunately for the pilots the "snapper" functioned at 3000 feet; had it occurred at 30 or 300 feet it is very likely the formidable oaken gates would have swung open and Odin would have had two more of our experienced pilots.

The system worked, as designed, but was unable to differentiate between a real ejection emergency and a foreign object impulse. Moral—Keep those cockpits clean!

Lt Col K. I. Bass (USAF) Ret.)

APPROACH END BARRIER ENGAGEMENTS—A pair of F-102s recently made intentional approach end engagements of BAK-9 barriers. Both engagements were successful and probably averted major aircraft accidents. Circumstances involved in the two cases were:

During takeoff the left main tire blew just prior to lift-off. The aircraft became airborne and the tire failure was confirmed by the pilot of another aircraft. After considering aspects of the emergency, a decision was made to perform an approach end engagement of the BAK-9 barrier. This decision stemmed largely from the probability of loss of directional control during landing roll. First, the MA1-1A barrier on the approach end of the runway was removed to prevent an inadvertent engagement in the event the aircraft touched down short. After reducing fuel load to 1800 pounds, the pilot set up a five mile straight in approach, gear down, speed brakes and tail hook extended. The aircraft touched down on the right side of the runway at 140 knots, 1200 feet from the BAK-9 barrier. The pilot deployed the drag chute and lowered the nose wheel to utilize nose wheel steering for directional control. Immediately after touchdown severe vibrations were experienced from the left wheel. These vibrations were so severe the UHF radio was re-channeled and the pilot was unable to determine whether the nose wheel steering was operating. Marginal directional control was maintained with right brake, however the severe vibration from the left wheel caused a break in the high pressure pneumatic lines. Loss of the high pressure pneumatic system caused the drag chute to jettison. Effective directional control was lost and the aircraft began an uncontrollable swerve to the left. At this point the tail hook engaged the BAK-9 barrier near the center of the runway. The aircraft stopped 724 feet after engagement. The pilot reported deceleration forces to be very mild, comparable to those experienced during drag chute deployment. The pilot escaped injury and aircraft damage was limited to incident classification. Cause of the blown tire was not determined.



The other planned approach end engagement occurred at the end of a routine training mission when the pilots of a TF-102 were unable to extend the right main landing gear. Normal and emergency gear extension procedures were tried, but the right gear remained in the wheel well. The canopy was jettisoned on final approach and the arresting hook was extended approximately one foot in the air as the aircraft crossed the approach end of the runway at 150 knots. Engagement was successful and the aircraft was brought to a stop 735 feet from the engagement point. The right wing dropped to the runway after 150 feet of roll and the nose gear failed shortly thereafter. The pilots were not injured and total damage fell in the minor accident classification. Runway barrier configuration in this instance included an MA-1 barrier installed on the overrun, 55 feet from the BAK-9 barrier. The MA-1 was in the retracted position during this approach and landing. The tail hook struck the runway 12 feet prior to engaging the BAK-9 barrier. Failure of the right main gear to extend was due to the right tire being caught on top of a locally fabricated metal box. This box had been installed in the wheel well as a container in which to store landing gear pins.

Although there are numerous variables involved in a decision to attempt an approach end engagement of a BAK-6 or BAK-9 barrier, these two instances point out a capability which should be considered when landing the F-102 under certain emergency conditions.

Capt Vernon G. Knourek, Directorate of Aerospace Safety

Aerobits

EJECTION SEAT AND RESCUE HELICOPTER—There has been some discussion of whether or not the possibility exists of a static surface or subsurface ejection from a floating crashed aircraft into the rotor blades of the rescue helicopter. The Naval Air Engineering Center has released the following information concerning the trajectory of ejection seats from aircraft that have crashed in the water:

- If the pilot should eject with the aircraft floating on the surface, the seat will travel in an aft direction, 11 to 23 degrees from the aircraft vertical, and will attain a height of approximately 60 feet (although rocket-assisted ejection seats attain a greater height, the trajectory of the seat approximates that of the standard seat). The aircraft will remain afloat from zero seconds up to a maximum time of about one minute depending upon the weight of the aircraft and the integrity of the airframe following contact with the water. Usually they will stay afloat for less than 30 seconds.

- As a general rule, if the canopy and cockpit are intact, the aircraft will sink in a tail down attitude, throwing the ejection angle farther aft. If the cockpit is flooded, the aircraft will sink in a level or slightly nose down attitude. Sinking rates of aircraft will vary from about two feet per second to 12 feet per second, depending upon the destiny and the integrity of the aircraft, particularly the cockpit area.

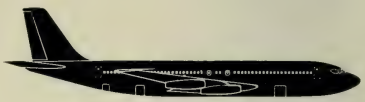
- Once the aircraft has reached a depth of eight feet, which will occur in from 3/4 of a second to four seconds, the seat if ejected will just about break the surface of the water, but will not attain any height in the air.

Based on this information, it is reasonable to assume that the safest position for the helicopter to hover for the rescue operation is forward and slightly to one side of the cockpit. Once the plane starts sinking there is practically no danger to the hovering helicopter if the pilot should eject from underwater.

NASC Personal/Survival Equipment Crossfeed

DANGEROUS DRY ICE—Less than five minutes after departing blocks, passengers aboard a combined cargo-passenger-loaded transport complained of breathing difficulties, and some went on oxygen. The loadmaster, observing this, reported to the aircraft commander who immediately put both aircraft air conditioning packs on, taxied back to the ramp and off-loaded his passengers.

Cargo consisted of 41 boxes, each containing 84 frozen meals and 50 pounds of dry ice. Dry ice is solid carbon dioxide (CO_2) that gives off carbon dioxide gas at temperatures above minus 78°C. CO_2 displaces oxygen in the air, has physiological effects on the body (increased breathing rate) and, in concentration, can cause suffocation.



AFM 71-4 lists the following formula for computing the maximum amount of dry ice to be placed aboard pressurized transport aircraft:

$$\frac{\textit{Vol of acft} \times \textit{Nr of air changes per hour} \times .47}{32.2}$$

For this particular aircraft, volume is 5313 cubic feet. Air changes per hour: 19.2, but this is airborne in normal cruise condition with both airpacks operating.

Air changes per hour on the ground with all engines at idle is only 2.5. With air packs off, as checklists stipulate, it's even less.

This aircraft carried 2050 pounds of dry ice. According to AFM 146-2, Section C: "A conservative guide is to use one pound of ice for each 10 meals for each 24 hours." Using this guide, 343.2 pounds of dry ice would be required. There was six times this much on board. According to the formula above, 193.87 pounds is the maximum amount of dry ice that could safely be carried in this aircraft on the ground, with both air packs operating. The aircraft was loaded with over ten times this amount and, until the loadmaster reported that the passengers were having difficulty breathing, the air packs were not on.

Cause factors in this incident were listed by the investigating officer as: Primary—Approximately 2050 pounds of dry ice used vs. 194 pounds being the safe limit. Contributing—Failure to document and label the boxes as "dangerous material" or "special handling required." (Dry ice is listed in AFR 71-4, AFM 146-2 and MM 76-1 as a "dangerous material" and 76-1 requires "special handling" labeling.) Failure to surround and cover the boxes with insulating blankets and tarpaulins as required by AFR 7-4. Instructions to "overpack with dry ice"—a phase that has about as many meanings as there are people interpreting it. ☆

WELL DONE

1st Lt. George F. Baker Jr

401 TACTICAL FIGHTER WING, ENGLAND AIR FORCE BASE, LA.

First Lieutenant George F. Baker, Jr., was on a dart towing mission in an F-100D. As he reached the firing range, his TACAN system failed and he could not establish contact with GCI. Unable to maintain a positive position within the range area over the Gulf of Mexico, he decided to return to Chennault AFB and land. He rolled out on his pre-computed heading and the control stick moved suddenly to the full aft position. The aircraft nosed up abruptly. By pushing forward on the stick with both hands, Lieutenant Baker was able to maintain straight and level flight. Emergency procedures failed to correct the difficulty because the trim system was completely shorted. By placing his knee against the stick, Lieutenant Baker found that he could release one hand for short periods to adjust the throttle, change radio frequencies and still hold the aircraft generally level. He realized a dart drop at Chennault would be extremely difficult and dangerous so he attempted the drop over a clear area in the Gulf, but the release system malfunctioned. To prevent damage to persons and property off the end of the landing runway, Lieutenant Baker decided to drag the dart off in the designated drag-off area. He then climbed to a downwind leg and, using the knee and arm method, lowered gear and flaps. Despite difficulties adjusting power on final approach, he made a safe landing.

Through skill, knowledge and strength, Lieutenant Baker safely recovered a disabled aircraft without damage to property or personnel. He accomplished an outstanding feat of airmanship that reflects credit upon himself and the United States Air Force. Well Done!

WINTER'S GRIP

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FLYS

AEROSPACE SAFETY

UNITED STATES AIR FORCE

The Inner Man
Page Six

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February 1964

EDITORIAL

Seven Million Dollar Switch

When Center called, the pilot in the right seat responded by pressing what he thought was the mike button on the yoke. Immediately the cockpit was flooded with white light. Quickly he raised his left thumb. The light went out. He pressed with his right thumb; the familiar click of the transmitter opening came through the headset and he answered Center's call. He was an aircraft commander who did most of his flying from the left seat. The mike button on the left wheel is on the left side, and just the opposite on the right wheel.

The task was an operational check of a tail hook modification. One mechanic was seated in the cockpit. Upon instructions that he actuate the tail hook down switch he inadvertently actuated the wing tank release switch. Both external fuel tank jettison systems were actuated. The tanks fell to the floor, ruptured, and a major fire resulted. By the time the fire was out two first line Century Series fighters had been destroyed.

SEVEN MILLION DOLLARS!

Why?

In each case a perfectly normal human reaction resulted in actuation of wrong switches. In one a cockpit was momentarily bathed in white light; in the other the result was a seven million dollar fire. The reason is well known under the common human behavior pattern dubbed "Murphy's Law." The frequency with which the law is exhibited is somewhat in direct proportion to the ease with which it can be accomplished. (Most inadvertent gear retractions after touchdown occur in aircraft with gear and flap handles of like shape and in close proximity.) Another Murphyism goes something like this—make it possible to do it wrong, no matter how difficult, and someday, someway, someone will do it wrong.

The blame? Everyone has been blamed, from the man who actuates the switch to some unidentifiable individual way back who designed the system.

But blame only irritates those accused; it doesn't prevent accidents.

The real accident prevention objective is to effect a cure.

The cure?

It's pretty obvious by now that not much will ever be accomplished in the way of remodeling man. He's probably going to continue to inadvertently actuate wrong switches as long as he can reach them. It should be just as obvious that mere knowledge of the Murphyism trait will not help—certainly the defeatist attitude "this sort of thing happens every once in a while, you've got to expect it," won't do the trick either.

One thing that will help is to make the wrong act more improbable: by changing size and shape of actuators, use of guards, safety wires, physical locations distant from other actuators that can be disastrously confused (bathing the cockpit in white light at night is probably more annoying than dangerous). Pointing the finger at the designer won't do it.

A genuine team effort will help. Everyone, from the designer on, must consider this hazard. There are a lot of mods, many of local nature, that bear watching. Anyone who ever sits in an airplane cockpit and actuates any controls must understand what he is doing, and the hazards inherent in actuation of other controls. Whenever operations personnel discover a potential of this nature they must brief all their potential "Murphys" and inform higher headquarters through operational hazard reports or other communications media established for such purposes. Inadvertent drag chute jettisonings were good examples—the normal human physiological action of turning the arm as it is drawn toward the body was the cause.

Modern weapon systems combined with human beings make this "inadvertent action" cause factor a real challenge. But every once in a while because of look-alike, feel-alike, work-alike controls, an accident occurs, like the seven million dollar fire, that makes everyone's effort worthwhile. ☆

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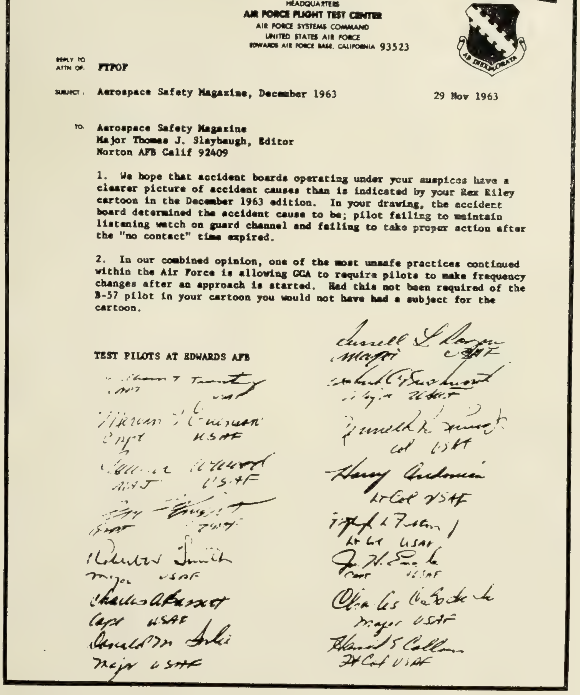

HEADQUARTERS
AIR FORCE FLIGHT TEST CENTER
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
EDWARDS AIR FORCE BASE, CALIFORNIA 93523

REPLY TO ATTN OF: FTPOF

SUBJECT: Aerospace Safety Magazine, December 1963

29 Nov 1963

TO: Aerospace Safety Magazine
Major Thomas J. Slaybaugh, Editor
Norton AFB Calif 92409

1. We hope that accident boards operating under your auspices have a clearer picture of accident causes than is indicated by your Rex Riley cartoon in the December 1963 edition. In your drawing, the accident board determined the accident cause to be; pilot failing to maintain listening watch on guard channel and failing to take proper action after the "no contact" time expired.

2. In our combined opinion, one of the most unsafe practices continued within the Air Force is allowing GCA to require pilots to make frequency changes after an approach is started. Had this not been required of the B-57 pilot in your cartoon you would not have had a subject for the cartoon.

TEST PILOTS AT EDWARDS AFB

USAF
Capt USAF
MAJ USAF
Major USAF
Charles A Bassett
Capt USAF
Donald M Sorlie
Major USAF

Major USAF
Major USAF
Col USAF
Harry Andonian
Lt Col USAF
Lt Col USAF
Capt USAF
Major USAF
Lt Col USAF

DECEMBER COVER

The cover picture for December was furnished by the San Bernardino Sun-Telegram Company. This courtesy is greatly appreciated, and delay in acknowledgment is regretted.

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Volume Twenty Number Two — USAF Recurring Publication 62-1

THERE' TIME TO TH

More than a few accidents and near accidents point up the fact that action is being taken more on the basis of instinct than methodical thought. And, when this is the case, a livable emergency can become less so. To wit:

On a routine transocean flight one of the engines of a four-engine transport failed. During the course of the engine failure checklist the engineer inadvertently pulled the firewall shutoff control on one of the other engines. This wasn't discovered until that engine began running rough. By the time this mistake was discovered the engine had failed and it too had to be shut down. Instead of a routine three-engine flight to a suitable field a harrowing two-engine flight of nearly 1000 miles resulted.

In the article "Two Minutes to Disaster," which appeared in this magazine in July, primary cause of the major accident of a twin-engine transport was attributed to "Inadvertent application of full carburetor heat on operating engine resulting in loss of power and ground impact." This occurred during performance of engine failure procedures after an engine had been shut down shortly after takeoff.

Then there were the U-3 troops who lost an engine and quickly ran through the "Engine Failure, Flight procedure—so quickly that almost before they knew it they had feathered the prop on the good engine. Their opposites might have been the U-3 crew who watched their fuel supply dwindle and dwindle and dwindle as they flew along above the overcast until finally the little engines experienced fuel starvation symptoms during the penetration.

To get back to the sergeants who engineer the beasts, here's one of the more recent TWX'd accounts: During climbout, at 2500 feet, the engineer reported oil quantity was dropping on Nr 2 engine. Oil quantity continued to drop to approximately nine gallons with oil pressure below minimum. The pilot instructed the copilot to feather. Fuel dumping was initiated. During engine shutdown and cleanup procedure the engineer inadvertently retarded the mixture on Nr 3 engine. He reported his error to the pilot and attempted to restart the engine. The aircraft began to lose altitude at the rate of 500 feet per minute, even though maximum power was used on Nr 1 and 4 engines. Successive attempts to return Nr 3 mixture to autorich resulted in severe engine backfiring. Loss of airspeed and altitude continued and full external wing tanks were jettisoned to reduce gross weight. The flight engineer reduced the throttle setting and RPM on Nr 3 and subsequently obtained normal operation of Nr 3 but not until the aircraft had descended to 200 feet. With power on Nr 3, a climb was established and a normal three engine landing culminated the flight.

In the don't-think-before-you-speak category was the case of the pilot of the twin-jet job who experienced a dual flameout at altitude. When he reported his dilemma to the ground controller he was given the classic, "Stand By." This is a case wherein the aircraft exerted the pilot's emergency authority and down he came. It's not fair to our readers to leave this one in mid air so we will add that, at lower altitude, he was able to get relights.

In another case the crew converted their troop transport into an unintentional cotton picker by running it to a final stop in a field after loss of an engine during a low level mission. They never got around to completing that portion of the checklist that stipulates, "Cowl flaps, inoperative engine, Closed." Landing was made with cowl flaps full open.

Pilots of a jet trainer, low on fuel, made low go's because of traffic. Finally they ejected—fuel exhaustion. A parallel runway, suitable for emergency landings, remained unused.

Of course, inadvertent gear retractions are legend. They have occurred with sporadic regularity on all types of aircraft ever since the state of the art "progressed" from fixed gear. The crutch used to explain these was, for a long time, the proximity and similarity of gear and flap controls. Something new has been added—the drag chute. Here are some "for examples:"

NK

The F-105 touchdown was rated excellent—1200 feet from the end at 170 knots. After rolling 1300 feet the pilot inadvertently raised the gear handle (round knob that actuates in a vertical direction) in lieu of pulling the drag chute handle (a handle marked "drag chute" that operates in a horizontal direction.)

The student pilot in the TF-102 had difficulty locating the drag chute handle by feel after touchdown and inadvertently pulled the gear up instead. An extremely rough runway got credit for an assist on this one since it allowed the landing gear safety switch to become deactivated.

Here's one who was almost quick enough to avert that "awful scraping sound."

An F-101 jock, after pulling the gear handle instead of the drag chute handle, reacted by slamming the throttle forward and the gear handle back to the down position. The bird became airborne and the left gear returned to the down and locked position. The right gear started down, but was prevented from falling into position and locking because the right wing was too low. The right wing began dragging, the aircraft settled, veered to the right and finally stopped.

Share the plight of this crew. At 600 feet, after takeoff, an explosion shook the aircraft and fire enveloped the Nr 2 and 3 engine nacelles. The copilot reported, "visible fire and flame on engines 3 and 4." The pilot retarded Nrs 4 and 5 to what he thought was "Idle Stop." Instead, he went to "Cutoff." The pilot said he could see no fire on Nrs 4 and 5, but the tower and the copilot still reported fire. The pilot then noticed fire in Nrs 2 and 3. He shut these down. An attempt to restart Nrs 4 and 5 was unsuccessful. Altitude was being lost on the two-engine powered aircraft. The "prepare to bailout" order was given. As the aircraft stalled the crew ejected.

Sometimes, just sitting on the ramp, quick actions can cause trouble. The copilot, holding the checklist on his lap and using a flashlight to read by, read, "emergency power switch." He reacted by reaching for and actuating the "emergency gear switch." The aircraft settled on its fuselage. There was conjecture in this case that adherence to proper procedures, i.e., pins installed, might have averted this one.

There are at least two or three other examples, older, but probably worthy of repetition because they are so unusual.

A transport crew, bothered by the sound of the gear warning horn and the glare of the red light in the gear handle while making an approach, solved these two annoyances by, respectively, turning off the horn switch and placing a paper cup over the gear handle. End result—a short runout and lowered profile cost the Air Force quite a few dollars and use of a transport for several days.

In another case, this too a transport, the pilot is alleged to have looked across at his morose copilot during takeoff roll and suggested, "Cheer up." He got "Gear Up."

One more. The new owner of U-3 type equipment flared for landing, heard a horn, reacted to that quick fear of a gear up landing by initiating his go-around procedure. He got as far as advancing power and pulling the gear handle up, then remembered—the stall warning horn. Of course! He relaxed, retarded the throttle and DID land gear up.

Were there any simple, clear cut solution to accidents of this sort it would surely have been applied long ago. Suggestions provided the writer during an impromptu poll of IPs and project officers during preparation of this article fell primarily into these categories:

- Think
- Use checklists
- Know your aircraft and aircraft systems
- Practice, practice and practice until proficient.

One thing stands out in many accidents of this type—action taken by a crewmember *aggravated* the seriousness of the emergency, or turned a routine situation into an emergency situation. The emergency in which instinctive reaction must be taken, even before there is time for thought, is rare indeed—if it exists at all. ☆

Find the Fault

During the first six months of 1963, 12 major accidents occurred in the F-100 fleet which were characterized by loss of aircraft control. In 11 of those accidents the pilots were killed and had made no transmissions prior to impact. Investigations were failing to identify the causes for the accidents, although possible or most probable causes were determined to be pilot error, pilot incapacitation, spatial disorientation, or malfunctions in the flight control system. Research into each of the accident reports by the Directorate of Aerospace Safety produced no valid findings upon which to make recommendations for corrective action or fixes.

One day early in August, there were two additional F-100 accidents in which loss of pitch control was experienced. One malfunction occurred at altitude and the pilot safely ejected. The other occurred while the aircraft was in formation at 2500 feet, and the pilot was killed.

An assistance team, consisting of personnel from the Directorate of Aerospace Safety, SMAMA, MAAMA and flight control and airframe representatives was dispatched to assist in the investigation of the latter accident. No specific determination could be made because of impact damage and salt water corrosion. But significant operational and maintenance practices that adversely affected aircraft control were discovered.

At the request of the major command, the team evaluated autopilot and flight control maintenance practices at all F-100 bases within the command, for the purpose of deter-

Maj Clarence H. Doyle, Jr.,
Directorate of Aerospace Safety

mining whether these practices might, in some way, be influencing or inducing situations where lack of aircraft control is suddenly experienced. The team then visited F-100 bases in other major commands, looking specifically into autopilot/flight control maintenance and operational practices. Findings and recommendations are being published in a report to be disseminated to all F-100 using commands. Some of the general interest findings are as follows:

Pilots were not ground checking yaw damper and autopilot systems in accordance with Flight Handbook instructions. In most cases, pilots were not provided with checklists to perform this check and were not familiar with correct procedures. The Flight Handbook abbreviated checklist does not contain this check because instructions and procedures are contained in Section IV and not in Section II.

The autopilot function of the Automatic Flight Control System (AFCS) was infrequently used at nearly all bases due to lack of mission or training requirement. Wings committed to long overwater flights did attempt to peak up the AFCS prior to deployment. At all bases visited pilots generally expressed a lack of confidence in the reliability of the system and indicated little mission requirement existed for its use.

Pilots were generally vague on what constituted an autopilot discrepancy and were unfamiliar with tolerances in heading and altitude modes, oscillation limits in pitch and roll, etc. Their writeups were not concise or accurate, resulting in maintenance personnel not being able to effectively clear the discrepancy. In most instances, pilots were not afforded a maintenance debriefing by an autopilot specialist.

Pilots were generally unaware of the function of the AFCS Hydraulic Engage Switch, and of the added safety factor it provides (High Wire aircraft) in the event of an inflight malfunction.

Trouble shooting techniques to correct autopilot/flight control malfunctions were generally ineffective. This was most evident where the pilot experienced an airborne malfunction that affected aircraft control. A random, uncoordinated approach to clear these discrepancies frequently resulted in the cause for malfunction not being identified. In some cases corrective actions indicated on maintenance forms could not have corrected the malfunction.

Badly deteriorated wiring in non-High Wire aircraft was in evidence at all bases visited, but was more acute in USAFE aircraft. Deteriorated insulation in wire bundles can cause spurious signals and unwanted inputs to be introduced in circuitry affecting aircraft control, i.e., gradient changer, trim, or pitch correction circuits, and inadvertent engagement of portions of the AFCS.

Review of autopilot checkout procedures in periodic inspections and flight line maintenance indicated organizations were not using standard procedures and methods.

Conclusions reached by the team are as follows:

F-100 pilots in all using commands are experiencing inflight incidents and accidents involving the AFCS/flight control system that cannot be readily explained.

The F-100 AFCS/flight control system is a complex integration of electronic, hydraulic and mechanical components and systems that are so interrelated that the entire system must be operated, checked and maintained as an entity.

Since the autopilot is rarely used on local training missions, the autopilot portion of the AFCS is activated infrequently. This results in defective and/or maladjusted components developing without the knowledge of operator or maintenance personnel.

An accumulation of defective parts, components and/or systems out of adjustment which are unexpectedly brought into play by an inflight malfunction can result in unexpected flight control forces which the pilot may not be able to control.

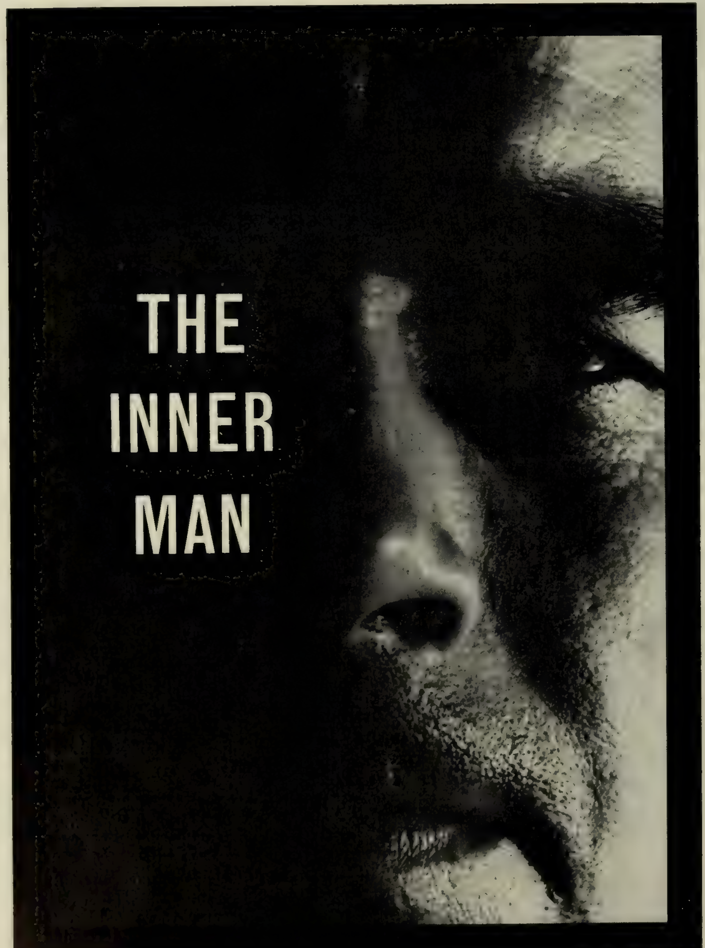
Badly deteriorated wiring in non-High Wire aircraft contributes to the unreliability of the AFCS/flight control system and substantially increases the possibility of the type of malfunction outlined above.

The inadvertent engage circuitry feature of the High Wire modification provides a substantial increase in safety of flight when malfunctions occur.

The AFCS cannot be safely deactivated without degrading the operational capability of the aircraft. Therefore, proper maintenance of the integrated AFCS is essential.

Actions currently being taken by all command levels and appropriate AMAs should result in a much improved and reliable F-100 aircraft. ☆

THE INNER MAN



Anchard F. Zeller, Ph.D.,

Directorate of Aerospace Safety

The sun was shining brightly on fluffy white clouds. Patches of green showed through some 25,000 feet below. Rays from the sun were picked up by scattered distant rain showers and reflected as rainbows, adding to the beauty of the day. It was a great day for living. Three minutes out a fighter pilot routinely contacted approach control and requested an ADF penetration. He was instructed to descend to 20,000 feet. He was next asked if he would accept a VFR descent to 5000 feet and was then instructed to descend to that level and await further instructions. Eight minutes later the pilot reported passing through the 5000-foot level, and when queried one minute later confirmed this altitude. This was the last communication received. Two minutes later a witness saw the aircraft strike the ground.

Scratch one aircraft. Scratch one pilot.

An attractive young woman sipped her drink and stared into space. Her preoccupation was such that she failed to notice the chaplain insignia of the stranger who approached her. A few quietly spoken words, dawning realization—the striking truth—a wife had lost a husband and four children a father.

An accident, with its aftermath of death, destruction, and human sorrow, is an unfortunate thing. Can some good come from even the most tragic? Yes, if lessons are learned and others prevented from falling into the same trap.

An accident board composed of honest, hard-working specialists could find nothing to pin-point the cause. After thorough and painstaking evaluation, the most likely cause became merely a statement of the obvious—the pilot lost control of his aircraft during approach and crashed. Yes, this was the cause—but why?

True the day was beautiful, but was the pilot in a position to appreciate its beauty? It had been almost a year since he and his wife had separated. During that time a new baby, now four months old, had been born. What conflicts tear at the soul and distress the mind when grave personal decisions are at stake? He knew that his wife would be waiting . . . waiting for a show-down. Would she be drinking? Drinking had been one of the problems which had led to the separation. Would any of the children be with her? What of their future? Are incompatible parents better than no parents at all from the child's standpoint? And then, the problem of religion. Had seemingly minor differences in faith at the time of marriage been aggravated to the point of being a factor in incompatibility? Were such considerations in the pilot's thoughts as he approached the forthcoming meeting?

It cannot be determined that any of these thoughts flitted through the mind of the pilot as he made his routine transmission and prepared for landing. If any did, their effect on an experienced, capable pilot in a routine flight termination can only be surmised. This is an all too familiar story. Only in retrospect can the problems which prey on a man's mind be related by inference to a faulty decision which led to his death.

When a bolt fractures, a line breaks, or a circuit fails, objective tests can often positively determine the difficulty. Once the problem is determined, corrective action can be initiated. Further observation determines the validity of the remedial action. So progress continues. But how does one determine that personal problems cause errors of commission or omission which in turn cause accidents?

It would be much more comforting if such a relationship could not be demonstrated; because, once demonstrated, the uncomfortable necessity of definite corrective action presents itself.

Take another case—a young pilot undergoing transition upgrading training. Takoff was initiated for a routine two-ship formation flight. Two thousand feet down the runway Mobile Control noted that the afterburner had failed to light. This information was transmitted to the pilot but was not acknowledged. The aircraft crossed the overrun still not airborne with the nose high and the tail dragging. Three times the aircraft bounced into the air and returned to the ground. On the fourth bounce the aircraft disintegrated against a tree and burned.

Again a wife was waiting—eight months pregnant in a strange town in a country where the people spoke a foreign tongue. Again the sorrow for a husband lost and a child who never would know its father.

But how does this relate to personal problems? The pilot was known to be anxious concerning his wife's condition. He had arranged to complete his transition in approximately one-third of the required time. He had not only volunteered but had actively initiated efforts to take every flight possible in order to expedite program progress. Was a calculated chance taken in attempting a takeoff without afterburner in order to avoid losing a flight? Not all incidents are so dramatic. Embarrassment—an aircraft damaged —a gear-up landing—one of the most aggravating problems which the Air Force faces. Here's another. As usual, the pilot could offer no good explanation. On turn to final he had reported the gear down and locked. A normal landing was then accomplished; normal except that the gear was up.

Again why blame personal problems? The pilot concerned was known to be having marital difficulties. A short time previously he had experienced an automobile accident, when he had turned left directly in front of an oncoming car. Some time prior to the flight which terminated in the gear-up landing, it had been noted that he appeared confused and his speech disorganized. Were personal problems involved? Who can definitely say? Is there a better explanation? Perhaps. It was the pilot's third approach; possibly he recalled putting his gear down previously. Other pilots, however, land successfully following multiple approaches involving repeated lowering of the gear; so personal problems remain suspect.

More examples? Take the case of. No, . . . this approach has contributed about all it can. How about statistics? Solid numbers lend respectability to any thesis. If assiduously used they can sway even the most skeptical.

Good statistical support requires only three things. First, the number of accidents attributable to human error; second, the number of these in which personal problems played a part; and third, in order to put this number into perspective, a determination of how many pilots who have personal problems do not have accidents.

At first glance a relatively simple task. Well known numbers appear to apply. To begin with, at least half of all accidents and probably as many as two-thirds are the direct result of human frailty.

Now how about the personal problem aspect? Here the problem becomes a little less clear. There are a number of occurrences where the individual experiencing the accident can be shown to also have had personal problems. But how about those who fly accident free? Do they also have problems. Of course they do. The problem now arises of determining whether this group has problems as acute or as frequent. Here the statistician polishes off his formulae, oils the machines, and eagerly reaches for numbers to turn into a clear answer. Unfortunately, numbers are not forthcoming, so the mathematician washes his hands of the whole affair. What becomes of the problem? It's still there. Should an attempted answer resort to still more examples. No, because no matter how frequent the examples, and there are many, they will never result in conviction unless the individual is emotionally prepared to accept the fact that personal problems can be a factor and act accordingly.

Who can say for sure that a pilot who crashes unaccountably is distracted by marital tensions, financial worries, or philosophic conflicts? Yet each individual who examines his past will almost certainly attest to the fact that such distractions cause faulty behavior, lapses in attention, carelessness to detail, even recklessness. Now, do these cause accidents? Of course they do. So it is assumed as self evident that personal problems contribute to accidents without specifying to what degree this contribution is involved. Does this acceptance mean that a certain number of accidents are inevitable?

This brings into focus the requirement which it was hoped could be avoided. Namely, what can be done to prevent accidents caused by personal problems? The first step toward the solution in any problem is the recognition that the problem exists. Once each individual who may be concerned—this is everyone —accepts the fact that his personal problems may interfere with his efficiency, the battle is half won. Even though the problem of preventing accidents may not be solved directly, it may be attacked by indirect action.

There is a fine line between prying into someone else's affairs and showing one's concern. When one's problems become aggravated enough someone may offer help. An observant commander is in an excellent position to do so. The desire to avoid prying, however, makes such action difficult. Good friends are often in the same position. Professionals—Flight Surgeons and Chaplains—often have fewer compunctions about prying but are not usually in as good a position to note behavioral changes.

The result is that most of the time each individual must act as his own counselor. After all, in many instances who else knows? Everyone dislikes admitting weakness. There was a time when it was difficult to persuade some pilots that it was necessary to use oxygen for high altitude flight. The inability to stand the rigors of such flight without the use of oxygen was considered weakness. This was sheer folly. As everyone is adversely affected by oxygen depletion, so everyone is affected by emotional upset. The recognition of this truth will do much to overcome the feelings that failure to operate at peak efficiency in the face of severe emotional problems is a unique individual weakness. It is rather a universal limitation of the human race. The wise self-counselor will consistently seek help when not in optimum condition to cope with his problems. The genuine sympathy, understanding and practical help forthcoming when help is asked for is most gratifying.

Remember, there are seldom any problems as acute as those which follow an accident. ☆

If it says AFRES or ANG, anticipate . . .

FACILITIES LIMITED

You think to yourself that this is a real professional operation. The approach controller seems to anticipate your every requirement. He provides vectors, works you down to pattern altitude, sets you up on ILS final. You marvel at his skill. He talks constantly. If there were one more aircraft on the frequency you are sure he couldn't handle the traffic. You find yourself trying a little harder. Your acknowledgments are brief and crisp. You appreciate good service, and you try to show your appreciation by flying exact headings, altitudes and rates of descent.

You are in the clear now, the runway lights straight ahead. "You are 10 miles out on ILS final for runway 32. Switch to tower, channel 236.6, now."

"Roger, going to tower, 427," you acknowledge and change frequencies.

Tower's frequency is also jammed. You listen for a pause and report, quickly, "Air Force 15427, ten out for 32."

"Roger, Air Force 15427, report three miles. Lights on, please."

You oblige. At three miles you call with the gear and are cleared to land. Three runways are in use. Blinking red beacons and pairs of white landing lights are in every quadrant. You are cleared all the way and given the ground control frequency for use after clearing the runway.

Ground control is busy too. He sends you off in the direction of the military ramp. You leave the lighted area and slow your taxiing. Finally, you come to an intersection. Which way? "Ground control, Air Force 15427. Is there a Follow Me?"

"Negative, Air Force. You are on your own."

From here on out you find out what "on your own" really means. There is no one to help you. You follow a taxiway until you find a ramp with a few C-119s, C-47s and a pair of T-33s on it. Nobody meets you. There isn't a light in sight. Finally, and slowly, you select a spot and park alongside a Gooney Bird. "Hey, Sarge, we got any chocks and tie down ropes?" you ask.

Finally you get everything shut off. You leave the brakes set because you have no chocks and you hope the wind doesn't get too strong because you have no tie down ropes. It's a long walk to the dark hangar. Your B-4 bag bumps against your leg and you change hands as your arm tires.

You head for a small door at the end of the hangar and find that you haven't been completely forgotten after all. There is a piece of paper fastened to the glass and with the aid of the engineer's flashlight you read "INFORMATION FOR AIRCREWS ARRIVING AFTER NORMAL DUTY HOURS." That's you. You follow the instructions and go down a darkened hallway until you come to an office with the sign, "Base Operations." The door is unlocked, and pasted on a window inside is information that, if followed, will get you by.

You learn that the white phone is a direct line to FAA Flight Service, and you are to use it to close your flight plan. The sheet also says that aircraft servicing can only be accomplished between 0800 and 1630, that maintenance is extremely limited and parts and personnel from the transient aircraft's home station will have to be flown in for specialized maintenance. There are neither quarters nor messing facilities. Motels and hotels that give military rates are listed. Pickup service is provided by some, with the numbers to call beside them. Six nearby eating establishments are shown, with the notation on two that they are open 24 hours. You note too that upon departure flight plans must be phoned in to Flight Service and after takeoff it is the pilot's responsibility to report his off-time and request that his flight plan be started by calling a nearby radio facility.

The above is representative of many civilian airports on which a Reserve Forces unit is located. But all this need not come as a complete surprise. Check the Enroute Supplement, Airdrome/Facility Directory section. If it says (AFRES) or (ANG) you can anticipate just such a situation as depicted in this article. Be sure and read all the information. Mondays and Tuesdays are the Saturdays and Sundays for many such facilities. Most of these units are not authorized sufficient personnel to permit 24-hour (daily) operation. You do get good service during normal duty hours, and, with advance notice, when you are on official business involving the unit on that base, they will go to extra effort to give good service, even after normal duty hours.

It's like a lot of other things; if you plan ahead, then use your head, you can operate into and out of Reserve Forces installations safely and efficiently. ☆

Flying in SEVERE TURBULENCE

ED NOTE: The following article deals specifically with commercial aircraft, the Boeing 707 and 720B. The information, except for representative speeds, altitudes and thrust settings, applies generally to all swept wing jet transports and bombers. Speed, altitude and thrust setting differences between similar military and commercial airplanes result from differences between military and civil flight regulations. Therefore, always refer to appropriate flight manuals for specific penetration information. The editors, courtesy of the BOEING AIRLINER, are reprinting this article in the interest of flight safety.

Recent incidents and data records from rough air encounters suggest the need for a refresher discussion of rough air flying techniques. An opportunity is thus presented to update the handbook procedural material to reflect the modern level of knowledge about atmospheric turbulence. To set the stage for such a discussion, it is perhaps useful to review, in skeletal form, the history of the development of rough air flying concepts. In the earliest decades of flight, low altitude flight was the rule, and weather was a dominating factor in deciding whether or not to attempt the flight. Flight speeds were not much greater than the gust velocities that might be encountered in severe storms. From the standpoint of blind flying, available instruments were inadequate, to say the least, and passenger comfort, while recognized as a desirable objective, was hardly a controlling feature of the flight plan. One might say that a totally smooth ride was highly unusual. In the later decades of the piston age, medium altitude flights became common, enroute weather became less of a factor, and transcontinental flight legs were longer, thereby allowing increased use of alternate courses to avoid weather and known severe turbulence. Radar became common for weather avoidance or picking one's way through stormy conditions, pressurized cabins increased the range of altitude available for attempting to avoid turbulence, flight through severe turbulence became less common, and normal flight speeds increased to values substantially greater than gust velocities which might reasonably be expected.

About this time, the rough air speed concept formally entered the design and operating practices of the industry. During this period, concern was largely centered on storm induced turbulence—the kind which can usual be seen—although the ability of later aircraft to operate occasionally in the lower fringes of the jet stream brought the early experiences with clear air turbulence. The higher speeds of the then current transports increased the risks associated with inadvertent penetration of severe turbulence and made it possible to penetrate further into regions of greater turbulence more quickly.

With the advent of the modern jet transport, the capability for flying over the weather was substantially increased. However, the need to climb and descend through the full altitude range remained. Although high altitude flight has been accompanied by increasing experience with clear air turbulence, most of the jet transport encounters with severe turbulence seem to be associated with thunderstorm activity. Reliable first-hand accounts by aircrews who have deliberately penetrated thunderstorms during the National Severe Storms Project or who have unexpectedly penetrated severe turbulence at other times, together with recording instrument data obtained during these encounters, has made possible a fairly accurate reconstruction of the events that occur. The observations which follow are based on an examination of these records and are intended to be helpful to those who may experience such encounters in the future.

In severe turbulence, two major concerns naturally arise in the pilot's mind. One is the concern of imposing excessive structural loads. The other is the concern that airplane attitude may reach undesirable extremes. Neither of these concerns is totally unjustified. On the other hand, the classical treatment of rough air penetration speed has perhaps placed too much emphasis on the structural aspects. Most pilots are well aware that flight through a given set of gusts at higher speeds will produce higher load factors or g's and a rougher ride for the passengers than a penetration of the same turbulence at a more moderate speed. The admonition to slow down to the rough air penetration speed when entering turbulence has only served to reinforce this concern. Engineering methods for computing the effects of turbulence on structural loads are well known for an airplane in level flight at the time of entry into the turbulence and, as a result, the classic discussion of the rough air penetration problem has tended to focus on such calculations and emphasize the structural significance of high speed entry.

The other major concern, namely that of control, is a much less scientific and less tangible problem and therefore is perhaps lost to some degree in the usual technical discussion. It is important to note here that there is a strong suspicion, if not specific evidence, that almost every structural breakup that has occurred in severe turbulence has been accompanied by a prior severe change in attitude and a subsequent combination of stresses resulting from both the recovery maneuver and the severe turbulence. The ride-smoothing qualities of the flexible swept back wing and the high wing loading of today's modern jet transport make it particularly likely that any structural damage which might occur in severe turbulence will be the result of a severe upset and/or recovery maneuver in combination with the turbulence, rather than the effects of the turbulence alone. Thus, the usual simple calculations illustrating the allowable gust magnitudes at different speeds in straight level flight are perhaps not sufficiently pertinent to the real problem. Rather, some relationship to an upset condition should perhaps be developed as the basis for defining operating techniques in severe turbulence.

AIRSPEED

In recent incidents where flight difficulties have been experienced while flying jet transports in severe turbulence, a common factor has been the reduction of airplane speed to a value that was close to or below the minimum speed formerly recommended for turbulence penetration. While flight at low speeds is satisfactory in moderate turbulence and may seem more comfortable, there are several disadvantages to flying at low speeds in severe turbulence. First, the airplane is closer to stall buffet and, since the angle of attack changes caused by severe turbulence can be high, there is a greater chance of encountering strong and alarming buffeting and the accompanying high drag that will cause loss of altitude and tempt the pilot to make undesirable thrust changes. Second, because the trim changes due to thrust changes are higher in the low speed region, because the airplane is flying on the back side of the thrust required curve at low speeds, and because the trim changes required to keep in trim as the airplane changes speed are greater when flying in the low speed region than when flying at higher speeds, the difficulty of maintaining adequate control is compounded. Also, it is easier for the airplane to be laterally and directionally upset at the lower speeds when turbulence is severe.

Because of the disadvantages of low speed flight enumerated above, it is now considered desirable to emphasize flight at somewhat higher speeds than formerly recommended. The speeds now recommended (Fig. 1) for all turbulence penetrations tend toward the high side of the range previously recommended. For simplicity it has been considered desirable to emphasize only one indicated speed, 280 knots or .8 Mach whichever is

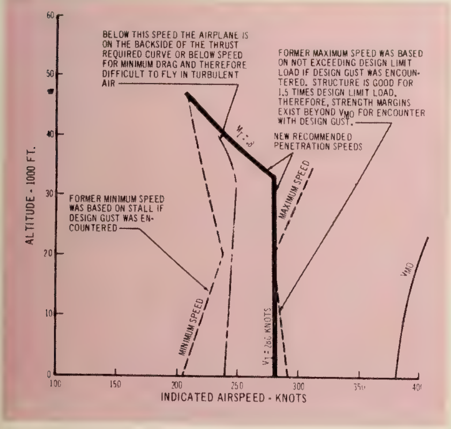


Fig 1. The new penetration speed is on the high side of the speed envelope previously recommended.

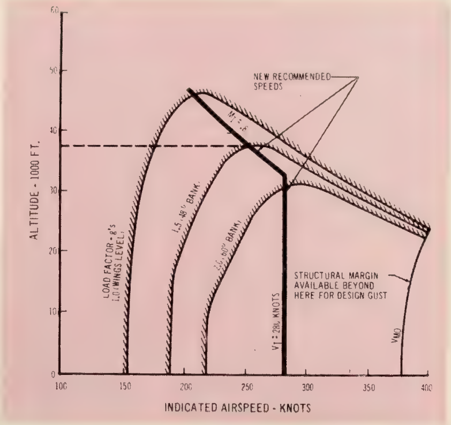


Fig 2. This chart shows the relationship between speed, altitude, and the load factor at which heavy buffet would occur. For instance, when flying at recommended penetration speed, heavy buffet would occur at a load factor of 1.5 at 37,000 feet.

less, as target speed with the realization that sizeable and rapid variations will likely occur depending on the severity of the turbulence. Above 35,000 feet a Mach number of .8 is recommended because of compressibility effects. M = .8 provides the maximum tolerance to high speed and low speed buffeting caused by any combination of high altitude, high load factor, and large gusts (Fig. 2).

The question then arises as to the general practices to be employed in attempting to hold within a reasonable variation from the target speed. Moderate variations, either above or below, are of minor consequence. Therefore, excessively abrupt or severe control motions should not be required, particularly when it is recognized that some of the fluctuation of the instruments is a result of the turbulence itself and does not necessarily represent a real change in the airplane's speed or altitude.

For the reasons previously enumerated, emphasis should be placed on flying on the high side of the target speed rather than the low side. However, it is considered highly undesirable to chase airspeed either with elevator or throttle manipulations since these efforts are usually ineffective and, as will be pointed out later, attitude should be the principal flight reference in turbulence.

ATTITUDE

Flying under extremely turbulent conditions requires techniques which may be contrary to a pilot's natural reactions. Rapid and large aileron control inputs are permissible to hold the wings level, but in extreme turbulence, pitch attitude must be controlled using only small to moderate elevator control inputs to avoid over-controlling or over-stressing airplane structure. The natural stability of the airplane will work in a direction to minimize the loads imposed by turbulence.

The pilot should rely to a major extent on this natural stability and not become too greatly concerned about pitch attitude variations. Since there is always the uncertainty of the direction, timing, and size of the next gust, it is often better to do nothing at all than to attempt to control airplane pitch attitude too rigidly. The moderate control inputs that are considered desirable will not always allow very precise attitude control. Ideally, elevator control should be applied smoothly in a direction to resist motions away from the desired attitude, and the elevator should be returned to neutral when the airplane is progressing toward the desired attitude. The above described technique will help prevent over-controlling, will reduce the size of pitch attitude excursions, and will result in less g loads than a technique which very closely controls pitch attitude (Figs. 3 and 4).

Pitch attitude should be controlled solely with the elevator, NEVER with stabilizer trim. Rapid changes in airspeed and attitude due to extreme gusts and drafts make stabilizer trim difficult to apply effectively. Also, any updraft or downdraft which might tempt the pilot to change trim can be expected to reverse itself in the next few seconds. If trim has been applied to counter the first draft, the second draft, which will likely be in the opposite direction, will exaggerate the out-of-trim condition. It is therefore considered desirable to LEAVE THE STABILIZER TRIM ALONE in severe turbulence.

THRUST

Once the proper thrust setting for the speed recommended for penetration is achieved, it is generally undesirable to make thrust changes during severe turbulence encounters. Large variations in airspeed and altitude are almost certain to occur in severe turbulence, and simple rules of thumb for setting thrust are not universally applicable for all altitudes and weights. The most desired thrust setting is one which will provide near level flight at the recommended penetration speeds in smooth air. In an emergency, however, an initial N_1 setting (for 720B series only) of approximately 93 per cent will be satisfactory at high cruise altitudes, and an initial setting of 84 per cent will be good at 10,000 feet. The most important objective is to obtain an initial thrust setting reasonably close to the correct one.

ALTITUDE

Because of the very high velocity updrafts and downdrafts in severe turbulence regions, large variations in altitude are almost certain to occur. Too much concern about these variations will merely lead to excessive control manipulations causing large g load variations and unwanted airspeed excursions. Altitude should be allowed to vary within reasonable bounds. At high altitudes or during high-speed cruise at intermediate altitudes, turbulence encounters may produce high speed buffeting (Fig. 2). The airplane has been flown into the high-speed buffet regime many times during flight tests in the process of determining and evaluating its qualities under these conditions. No unusual flight characteristics have been noted. However, to the uninitiated, the buffeting or shaking might be disconcerting, being somewhat similar in nature but more severe than the shaking that occurs under some conditions when speed brakes are extended.

When experienced in combination with severe turbulence, these effects might easily be incorrectly diagnosed as increased severity of the atmospheric disturbance, and result in an exaggerated assessment of the seriousness of the situation. Experience to date has shown that severe turbulence encounters at high altitude have caused positive g's as high as 2.5. However, it is believed that if the recommended attitude control procedures are followed, high load factors need not be imposed. Even though these procedures are used, an occasional encounter with high-speed buffeting in unexpected severe turbulence may be unavoidable above 35,000 feet. Such an occurrence should not be cause for great alarm nor be misinterpreted as a low speed stall with an accompanying rapid pushover for recovery, since any such action might aggravate the buffet situation by merely increasing the MACH number. This

TABLE I
CONVENIENT CHARTS OF THIS TYPE COULD BE USED FOR THRUST SETTING IN SEVERE TURBULENCE

TURBULENCE PENETRATION POWER SETTING
PERCENT N_1 RPM

G. W. 1000 LB	ALTITUDE – 1000 FT.			
	10	20	30	40
140	79.3	82.2	87.8	92.3
180	80.4	84.7	89.9	97.0
220	81.7	87.2	92.4	104.0
260	83.6	90.0	95.9	—

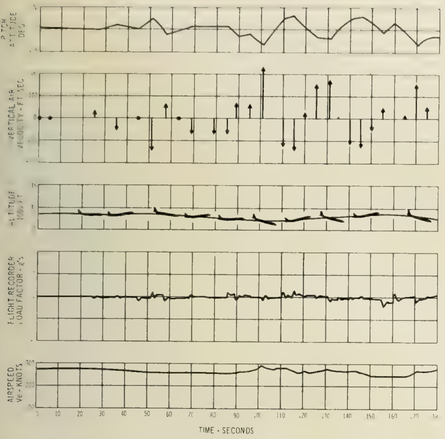


Fig 3. The indicated vertical air currents are typical of those encountered during penetration of severe turbulence. The other curves in this figure illustrate the behavior of the airplane encountering the indicated air currents without any pitch correction by the pilot.

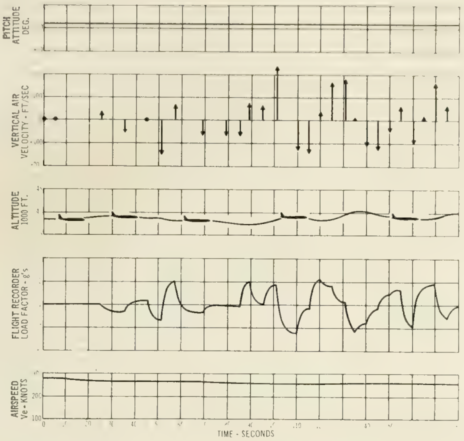


Fig 4. These curves show the behavior of an airplane encountering the same vertical air currents as in Fig 3, but with absolute pitch control applied. Although it is not possible to apply such absolute pitch correction, the curve illustrates the larger g loads by too rigidly controlling pitch attitude.

tendency to encounter high-speed buffeting in severe turbulence is increased with increasing altitude. It is therefore apparent that climbing in an attempt to avoid an area of expected severe turbulence could lead to this type of buffeting difficulty if the turbulent region could not be completely topped.

AUTOPILOT

It is recommended that the autopilot be disengaged immediately upon encountering severe turbulence. First, the autopilot has only limited authority over the elevator control system and will call for stabilizer trim motion to augment this authority when necessary. Thus there is a good possibility that the airplane could be placed well out of trim by autopilot action. Also, an inadvertent disengagement at an inopportune time might initiate a maneuver from which it would be difficult for the pilot to recover. Thus, although the autopilot will do a reasonably good job of flying the airplane in light to moderate turbulence, it is not recommended for severe turbulence flight.

YAW DAMPER

The roll and side slip motions of the modern jet transport are more difficult to control than its predecessor, principally because of its swept wing, its high weights, and the high altitudes at which it flies. This type of motion is quite uncomfortable to passengers and generally is difficult to cope with from a piloting standpoint. Because the motion is easily excited and poorly damped on swept wing configurations, the modern jet is equipped with a yaw damper to aid the pilot in flying the airplane. Flight test data substantiate that important benefits are obtained from use of the yaw damper during turbulence penetration. Excursions in side slip and roll are minimized and, even though the rudder control may be more active, the structural loads imposed on the vertical tail are considerably reduced. It is therefore recommended that the yaw damper always be engaged during penetration of severe turbulence.

PROCEDURE SUMMARY

In brief form, the procedures for flight in severe turbulence are summarized as follows:

1. Airspeed—Approximately 280 KIAS or approximately M = 0.80, whichever is lower. Severe turbulence will cause large and often rapid variations in indicated airspeed. DO NOT CHASE AIRSPEED.

2. Autopilot—OFF, Yaw Damper—Engaged. It is desirable to engage the yaw damper when the rudder is centered.

3. Attitude—Maintain wings level and smoothly control pitch attitude. Use attitude indicator as the primary instrument. In extreme drafts, large attitude changes may occur. DO NOT USE SUDDEN LARGE ELEVATOR CONTROL INPUTS.

4. Stabilizer—Maintain control of the airplane with the elevators. After establishing the trim setting for penetration speed, DO NOT CHANGE STABILIZER TRIM.

5. Altitude—Allow altitude to vary. Large altitude variations are possible in severe turbulence. Sacrifice altitude in order to maintain the desired attitude and airspeed. DO NOT CHASE ALTITUDE.

6. Thrust—Engine starter switches should be in FLIGHT START. Make an initial thrust setting of N_1 RPM for the target airspeed depending on engine type and altitude as follows:

	30,000 Ft and Above	**10,000 Ft**
JT3D3 -120B/720B	**93%**	**84%**
JT3D3 -320B/C	**95%**	**83%**
JT4A	**81%**	**75%**
RCO 12 (N_2)	**89%**	**85%**
JT3C	**94%**	**86%**

CHANGE THRUST ONLY IN CASE OF EXTREME AIRSPEED VARIATION. ☆

CROSS COUNTRY NOTES

...from REX RILEY

As usual Rex has been receiving mail, messages and accident/incident reports that just can't be passed up or filed. Sermons will be avoided but Rex can't help but hope that at least one of these tales will strike home and you'll remember it if a similar occasion arises.

GUARD CHANNEL AGAIN. Rex has long fussed about all pilots (USAF, Navy, civilian) and ground control garbling up "save your life" Guard channel but here is a case where the pilot should have and didn't. Mission: returning to base after low altitude intercepts. At 13,000 feet, reaching for 15,000, the pilot of the F-86L was 45 NM out at sea when he began getting severe fuel fluctuations. The emergency fuel system didn't help. The local Air Defense Sector gave him a vector to a Marine base closer than home base. The pilot contacted approach control and was told he was Nr 2 in the GCA pattern. He then requested a flameout pattern but kept getting GCA steers. After declaring a bona fide 100 per cent emergency he was told to go to tower on channel one. Channel one was all banged up with useless chatter so tower gave him another frequency. This one was occupied with a read back IFR clearance, so back to channel one. Still declaring an emergency he requested the active runway and the tower came through. The landing was uneventful. It's when you get in trouble that you use good old Guard and when you're not in an emergency, you don't. It's that simple.

LAUGH OF THE MONTH. A U-10A groundlooped after an otherwise successful landing. Damage was considerable. Cause: pilot factor in that the pilot lost control on landing roll. Here's the kicker—the investigation stated: "Pilot proficiency was not a factor." While Rex has never groundlooped an AT-6, C-45 (or a few others noted for this characteristic), he's come so close it wasn't funny. In each case the reason was not being quick enough or sharp enough or good enough. If that isn't proficiency (or lack of it) what do you call it?

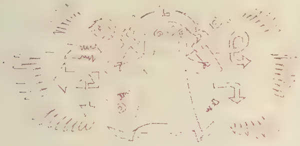
REX RILEY LIST OR NOT. Rex gets occasional letters griping about the facilities at a base that is on the Rex Riley list of recommended bases. Like a sergeant that wrote long and mean about the lousy visiting airman quarters at a southeastern Rex Riley base. It was so bad he ended up sleeping in the airplane. Then, the other day a troop in the same building with Rex came in storming about another Rex Riley Recommended base. It turned out that this was the third or fourth time he had been there and had received lousy service. The point is: it's up to your aircrews and passengers to get the word where it will do some good—namely Rex. Don't sit around and fuss—a letter, postcard or brown wrapping will do the trick if you give me the poop. I promise to answer and furthermore it doesn't take but a few reports (or one real bad one) and Rex will be there. If a safety of flight item is noted in your report, action is taken right then and there. It's up to you.

NOT NEW BUT STILL TRAGIC. During an emergency (high oil pressure) landing the F-100 crashed while turning to final approach. The pilot was killed after ejection. I won't go into the airplane troubles because the points to be made are:

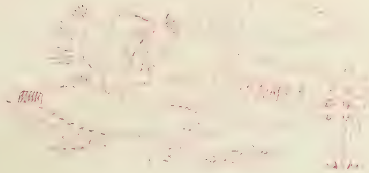
(1) Pilot did not have the zero lanyard hooked up.

(2) Ejection was at 200 feet.

Rex isn't fussing with a guy who lost his life doing his best trying to save an airplane. But what about you troops reading this stuff? Have you got a pre-determined altitude fixed in your mind at which you're going to hit the next-of-kin button and save your life? And if you think you can manually beat the zero lanyard you better turn in your license to fly and take a course in selling shoes.



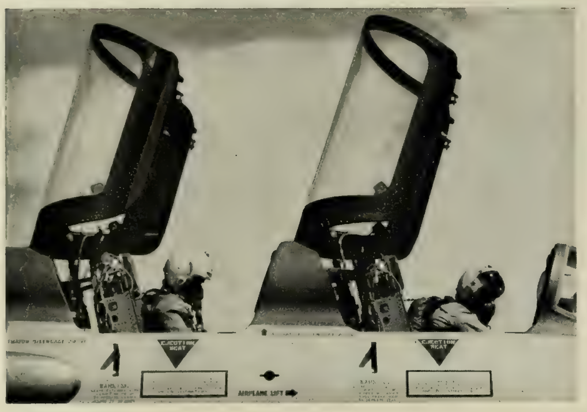
PLEASE, NOT AGAIN. As faithful ASM readers know, one of Rex's pet peeves is complicated requirements levied on aircrews. There has been some progress in recent years in reducing the number of frequency changes, etc., etc., but there is room for a lot of improvement yet in such simple and basic air maneuvers as the procedure turn. A recent FLIP planning change notice carries this: "Restriction: if the first outbound turn places the aircraft on the side opposite the maneuvering side turn to intercept the reciprocal of the inbound course. It is recommended that not less than a 20-degree intercept angle be used to intercept course. If the reciprocal of the inbound course is intercepted prior to completion of the maximum time outbound, maintain course outbound." S'help me, that's what it says. With a chalk and blackboard it is soon apparent that when the turn-shortest-direction-outbound procedure places the aircraft on the non-maneuvering side it is now necessary to intercept the reciprocal prior to turning inbound. Basically that is about it. But try this in an airplane, especially you proficiency pilots who can't get local practice but must pick it up on mission support flights. Gets a little confusing when you get to do it maybe once a month. 'Nother thing, when you run your bird around this imaginary track (throw in a little wind drift problem, as it's usually there) you'll find that you're pretty busy watching the gages. And when you are getting in a little VFR conditions practice in this procedure just who is keeping a close lookout for other aircraft? Rex says again, if it's safe, it had better be simple. The mental gymnastics required to fly some of the modern day patterns leave little time to sort out radio calls, Guard chatter, checklist reading and performing, change attitudes and altitudes, acknowledge and perform SIF changes, verify that the VIP's transportation has been ordered . . . there is no apparent limitation on what can be requested or required of a pilot at this phase of his flight. ☆



THAT'S CLOSE, MAN. Mission: F-100s (two on a hi-lo-hi navigation bit). During low level portion of mission, at turning point, the pilot lost sight of his wing man. While searching for him the pilot allowed his aircraft to descend to approximately 200 feet above ground level. He then saw power lines in his flight path but did not have time to take evasive action. The aircraft struck the lines which ruptured the right 335-gallon drop tank and bent it up against the inboard slat, damaging the slat. The pilot then climbed to altitude and performed a stall series to check for controllability. Control of the aircraft was marginal so the pilot elected to jettison the right tank at the tank jettison area. A malfunction occurred and both tanks released. Damage to aircraft: both right wing leading edge slats damaged, right wing tip damaged, both horizontal stabilator tips damaged, and minor damage to right wing leading edge.

OOPS! During preflight inspection of the missile bay (F-106A) the pilot noted that the spare drag chutes had been placed above the luggage carrier. He accepted this condition and took off from Podunk AFB en route to home station. During flight he noticed two dull thuds. No other unusual conditions were observed. After a low approach at Podunk, mobile control advised him that a drag chute was hanging from the missile bay. After landing, it was discovered that the drag chute had fallen from the luggage carrier onto the missile doors. The D-ring had evidently worked out through the air vent pulling the rest of the chute out in the airstream. The pilot chute did not go through the vent and kept the chute from falling from the aircraft. Lower anti-collision beacon destroyed. Main gear doors scratched. One two-inch tear and a five-inch tear in the lower aft fuselage skin. This damage was probably caused by the flailing D-ring. Corrective action was to advise all ground personnel to secure spare drag chutes on the baffle plate area with adequate tie-down straps or cable; inform pilots not to accept aircraft until all equipment has been properly secured.

WHAT IS IT?



If you haven't guessed yet what those two pilots above are sitting in, don't feel bad. Not many people have seen this bird yet. It's TAC's new F-105F, a two-seat version of the F-105D.

Designed primarily as a weapon to be used for the same missions as its single seat predecessor, the versatile two-place model will also provide actual mission, radar and instrument training. In this secondary role it will be employed to:

- Train in use of fire control system, radar and weapons delivery.

- Serve as a standardization/evaluation aircraft.

Since the two-seat version was designed to perform combat missions side-by-side with the F-105D, minimum performance degradation and logistics were prime design factors. Both cockpits are at the same level above the aircraft centerline in order to maintain performance. Wherever possible the same subsystem components were employed on both the single and two-place versions.

Major changes in the design of the F-105F are:

- Bigger vertical fin to maintain directional stability comparable to the F-105D.

- Reinforcement of the center and aft sections of the fuselage to take care of greater tail aerodynamic loads.

- A 350 knot gear retraction capability.

- Relocation of the angle of attack vane to the right side to preclude the possibility of damage during air refueling.

- Increased capacity of the air conditioning package.

- Redesign of the forward fuel cell with an additional pump to maintain CG control (fuel capacity same as in F-105D).

- Use of a combined canopy actuator/remover unit for each crew station.

- Simplified survival kits for easier maintenance and to improve reliability of the communication subsystem by removal of communication personal lead from the kit.

- A 750 VA static inverter to provide for increased AC electrical power requirements.

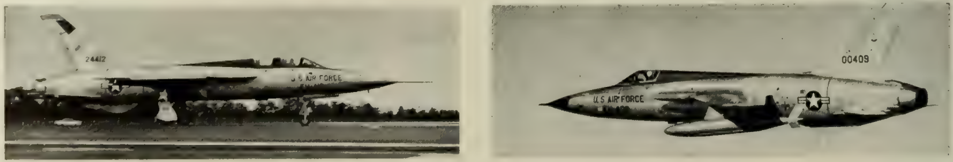
- Modification of control systems to provide dual capability.

Handling characteristics are reported to be similar to the single seat models with improved stability at high speeds and low altitudes. The aircraft may be operated at Mach 1.2 on the deck without stability augmentation. The absence of adverse yaw and pitchup tendencies make stick shakers and artificial stall devices unnecessary.

Engineering estimates indicate range loss as compared to the single seat version will be approximately three per cent. Top speed, for a given weight, may well be above that of the D model as a result of the longer fuselage.

Armament generally is similar to the D model. The two-seater is equipped with the M-61 Vulcan 20 mm gun and can carry AIM-9B and AGM-12 missiles as well as special weapons. The AGM-12A is not operated from the rear cockpit.

Maintenance features include unusually long tire life, highly reliable drag chute, and unusually durable brakes. Structural changes have eliminated the "ballroom" (electronic equipment compartment) and its congestion. There are two electronic compartments in the F-105F, one on each side of the aircraft below the aft end of the extended crew compartment. ☆



Something has been added. Two-seat version of F-105 fighter bomber (left) is contrasted with single seat version (right).

GOOD WAS MY COPILOT

Major T. J. Slaybaugh

At Base Ops Chumley was met by his copilot, a tall, alert looking lieutenant colonel who held out the completed '21a, the '175, a takeoff performance card and the manifest.

"Mornin' captain," he said. "I have the paper work finished, but you'd better check it; I've been flying T-Birds and just got a copilot checkout in the Goon so as to get a little refresher on the recip picture."

"Yeah, yes sir. Good for you." Chum wasn't so sure. Nobody had a right to look this alert at 0500. "You stan/eval?" he asked, suspicious.

"No." The little laugh didn't comfort Chumley much. "I'm what you might call special assignment. Flying safety is my racket, with transient services a growing sideline."

"Hmmmm . . ." Safety officers were next to stan/eval types in Chum's book. He'd play this one close to his vest. He glanced over the paper work. Everything was neat and legible and all the columns were filled in. Chum wasn't familiar with the detailed Section C of the '175 but did figure out that it was some type of operational clearance. The four bases where they were to stop were listed, along with ETAs, and their home field was shown as final destination. C. Z. shoved it over to the dispatcher. The dispatcher checked everything, following the end of his pencil along all the columns, slid it back with the suggestion that Chumley sign it. Then he handed C. Z. the carbon copy, saying, "Have a good trip."

Still suspicious, Chumley made a more careful walk-around than usual. The light colonel said he'd already been around with the engineer, but suggested that Chum would probably want to check it anyway. A drop of oil fell on his left cheek when he peered into the right wheel well; this served to make him wish he had stuck to his rule-of-thumb preflight—if you don't see anything dripping from 50 feet, take it. When he got aboard he found that the light colonel, checking items in a black notebook, was briefing the passengers. Chum shrugged and went forward. Hardly anything ever went wrong in a Goon.

Engine start, taxi and runup went smoothly enough. Chum curbed his impatience for a change and let the engineer run through all the items on the checklist. One thing he noticed, this copilot was the sharpest he'd seen on the radio; better even than that first lieutenant who had come in from an overseas tour in '100s.

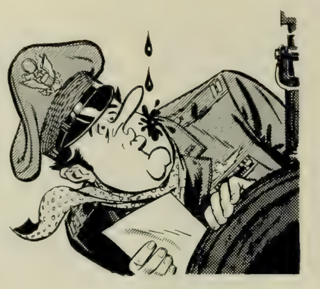
Takeoff was routine and climbout seemed normal enough to Chumley. The throb of the 1850s was sort of comforting in a way and Chumley began to relax a bit. Then his copilot had to spoil it all when he reached over on the pedestal, asked "May I?", and with a thumb and forefinger edged the right prop control back. The beat that Chumley had been used to for years smoothed to a steady blend of engine sound.

Chum didn't say anything, but copilot stock, which had begun to rise, dropped sharply again.

But by the time they made their first pax stop the light colonel was back in good graces. Chum, trying to figure it out, surmised as maybe this boy had some Geisha blood in him—the way he anticipated everything. He never gave C. Z. a chance to exhibit one of his more noted traits—forgetfulness. Chum even pictured himself as a doctor in an operating room the way this guy kept handing him maps, letdown plates, checklists, always just before he needed them. Everything was opened to the correct page, too. About five minutes out from terminal fix the copilot had received permission from Approach Control to file the IFR portion for the next leg. Best FAA guy ever—for the first time C. Z. could remember, nothing had to be repeated or added.

C. Z. didn't have much to do but sit there and drive and give the orders. He found he was sitting up a little straighter and when he had rolled the big, soft tires on at the first pax stop he felt a little thrill at the "squeech, squeech." (It had been quite a long time—even beyond his last proficiency when he had blown the left main in a tail high try at a short-fielder.)

The only rough moment came when he braked abruptly in response to "hold it" as they were turning between two other birds to park at Base Ops.



"Better hold it here a moment," his copilot explained, "AFR 60-11 says we have to have a wingwalker when within 25 feet. And, as you know of course, a tug within ten feet."

Chum nodded. He had thought it was 50 and 25, but didn't want to argue the point.

Seemed like they had just parked when this light colonel was climbing back into the right seat and making a circle with his thumb and forefinger. He'd been in the back again. Some kind of a nut on passenger briefings, apparently.

He handed Chum a thin folder. "SID departures, one of the passengers brought it for us."

Chumley just blinked. After all. They had forty minutes of IFR on the next leg. Our hero wasn't surprised when his copilot asked, "Be okay to take 'er off autopilot and keep my hand in?" C. Z. was a bit watchful for a few minutes, until he made the unusual discovery that this particular Goon obviously held headings and altitude better for hand flying than for autopilot flying. Chum shook his head and sent the engineer back for more coffee—real unusual airplane, and it landed well too.

At the next stop they had to hold 20 minutes. The bird flew so well in the holding pattern that Chum figured the copilot could make the approach without any trouble. That's the way it worked out, too. Because of the delay, and Metro's forecast of stronger winds on the next leg, C. Z. made the decision to add fuel, and refile. He was pleased to note that the copilot was thinking ahead too. In fact, he had suggested just such a course of action shortly before Chum had made the decision.

They checked weather together and as was his practice, Chumley let his copilot gain more experience in making out the paperwork. They had coffee, the light colonel picking up an extra donut for the engineer, and went back out to the plane. He opened his checklist as they approached the bird, but the passengers were en route so C. Z. waved him on with the comment, "I'll catch the outside if you'll get aboard. Won't take me a minute."

In his book, en route inspections, if made, were the engineer's duty. After a perfunctory, medium-distance look at the wheel wells he was satisfied; then he noticed his copilot up by the power unit, unrolling cable. When he walked over he heard, "Every once in a while somebody forgets to chock the bird, or set the brakes, or starts on a wet, sloping ramp and when the power unit is parked ahead of the nose or props the plane rolls into it. Goodbye, power unit, and sometimes goodbye airplane."

The copilot then helped the alert man pull the power unit to the length of the cable.

Thirty minutes later, airborne and out of the weather, the copilot pulled his little black book from a pocket of his flying suit and, between frequent scans for other aircraft, made entries.

"I've seen lots of little black books," Chum said, in an effort to be casual, "but never anybody making entries at eight thousand feet with no females on board."

The light colonel smiled. "It's not what you're thinking. I keep notes on facilities provided for transients at every base."

"Hmmmm," a little light began to flicker somewhere back in the cob-

webbed recesses of Chumley's brain. He let it perplex him a few moments, but the answer didn't appear. He gave up. That was another typical trait—give an idea a chance to jell and if it doesn't, forget it . . . couldn't have been worth much.

The second two legs were replicas of the first. This nothing-to-do-but-steer bit set well with Chauncey Z. Chumley. In fact he commented a time or two on how well rigged this particular plane was. His landings were much better than normal. And this copilot—once after Chum had hurriedly wadded up his L-3 chart and sat on it to get it out of the way, the copilot carefully refolded it without a word.

When they taxied in at the end of the mission, Chum was at his expansive best. "Colonel," he addressed his copilot, "You're coming along real well for having just been checked out. Enjoyed having you. Be glad to take you along again and give you a few more pointers. I'm going to tell training that, with a few more flights like this, you won't have any trouble checking out as AC—not any trouble at all."

The light colonel smiled.

After they had parked the bird and Chumley picked up the 781, the light flickered again, then came on bright. On the second line, neatly printed, was the name, "Riley, Rex. Lt. Col." Just to make sure, Chum called, "Colonel Riley . . . I thought I'd heard that name somewhere. Didn't you used to be in some sort of restaurant award business—sure, that explains the black book . . ."

Riley smiled. "No, you're thinking of two other guys. They've been retired. I'm just helping out, sort of an additional duty." His smile widened. "I'll see you . . . it's been interesting—most interesting."

He was gone, leaving Chumley scratching his head. He was puzzled for a minute, but he shrugged it off. One thing, Riley would have to admit it had been a good flight. The airplane had flown well. Four excellent landings. None of the usual trouble with traffic controllers. They hadn't been pestered with a lot of questions by the passengers. No hassl'ing with Base Ops types on the paperwork . . .

As Chum climbed out of the seat he remarked, to no one in particular, "You don't know how lucky you are, Riley, you should be along on some of the flights I make." ☆

TAC's

ACCIDENTS, INCIDENTS AND ALMOST . . .

▶ LOCKED RUDDER. After a normal formation troop drop sortie, a 360 overhead pattern was flown. As the C-123 was flared for landing the rudder locked in a near neutral position. Fortunately, there was little wind and the landing could be completed without incident. Directional control was maintained with nose steering. During rollout, when pressure was applied on the left rudder it became slack and rudder cables were observed hanging slack in the cargo compartment. The rudder torque tube right pulley had failed.

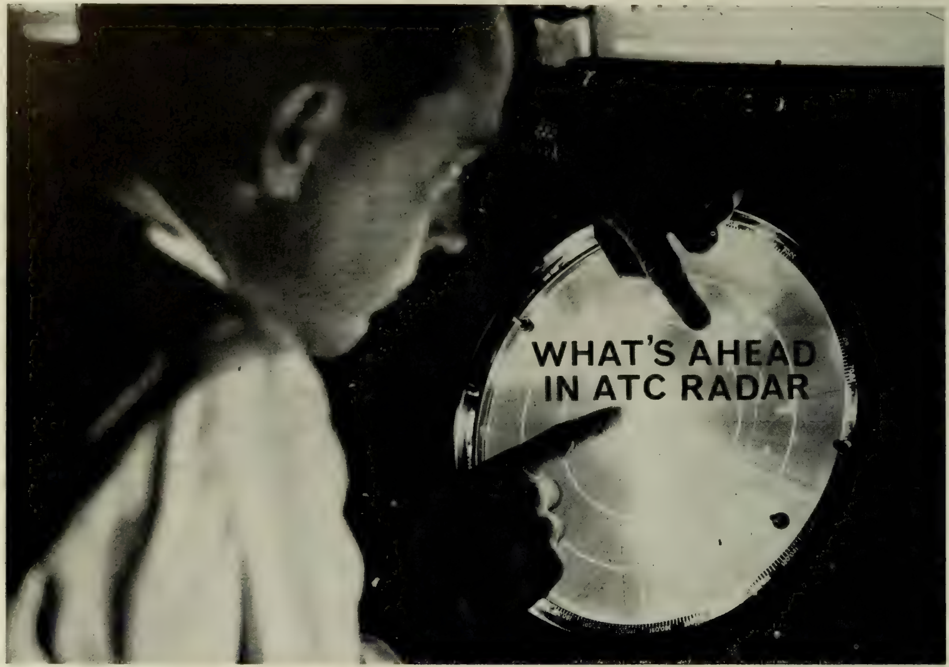
▶ C-54 PITCH UP. During roll out from a steep turn on an instrument practice flight, and as the copilot was applying nose down trim, a loud noise was heard. The aircraft immediately pitched up, requiring 30 to 40 pounds forward pressure on the controls to hold level flight. Movement of the trim wheel had no effect. With the copilot holding forward pressure to assist in overcoming heavy elevator force a landing was made. The cable to the elevator trim tab had broken.

▶ CLEAR BEHIND? As the engineer was beginning his operational check of propellers the pilot started a visual check of the control surface and, at this time, noted a light aircraft approximately 400 feet directly behind. The pilot of the light aircraft was obviously having control troubles. Power was retarded immediately, but not before the light aircraft was blown over onto its nose and right wing. Air Force crews must assure they have a clear run-up area, preferably in an area where other aircraft cannot be taxied behind. All engines should be positioned over a hard surface, particularly when reverse checks are to be conducted or jet vortices could pick up gravel or other debris. Turboprop crews must remember that pilots of other aircraft cannot estimate the amount of prop wash from sound and will not know whether or not they can safely taxi behind.

▶ LAPS FULL OF INSTRUMENTS. Shortly after passing S1 speed the pilots of the KC-135 noticed that the instrument panel was ajar. Immediately after rotation the top of the panel fell toward them. The pilot and the IP sitting in the right seat caught it after about four inches of movement, thereby averting a lap full of instruments, and the IP flew the aircraft while the pilot fastened the panel back in place. This was the first flight since the aircraft returned from the depot. Depot personnel had forgotten to secure the panel.

▶ FAULTY RAFT. During periodic inspection CO_2 cylinder was actuated, but raft failed to inflate. Removal of the cylinder revealed the filler fitting on the raft was not drilled, preventing gas from entering the raft. The fitting was cut from the raft to check for other discrepancies. Discharge ports were covered with rubber. Is there other such defective equipment provided for airmen down at sea?

▶ NO DOORMAN. After maintenance on the rudder the aircraft was being backed from the hangar. Someone forgot to open the center overhead doors and the rudder was torn in three places. An estimated 50 manhours was required to remove and replace and 100 hours to repair the damaged section. Of course, the aircraft would have to be out of service during this period. ☆



WHAT'S AHEAD IN ATC RADAR

Sometime before the end of 1967 an Air Traffic Controller will look at a blip on his scope and, beside the blip, see

AF12345
6284

And, if you are the pilot flying Air Force 12345 that day he will immediately know exactly where you are and that you are at a flight level of 28,400 feet.

Exactly who you are, where you are and how high you are—that's the information air traffic controllers will have on every military pilot by this target date if the goal established by the Secretary of Defense is realized. Programmed implementations to achieve this goal include:

Installation of the new Air Traffic Control Radar Beacon System (ATCRBS/IFF) in all aircraft types being delivered in 1965.

Action in current production designs so as to minimize retrofit.

A 20 per cent retrofit by the end of 1965 and a 60 per cent retrofit by the end of 1966.

Although the above refers to airborne retrofit goals, necessary military ground facilities retrofit requiring interrogator, decoder and display modifications are anticipated in a corollary program.

To best understand what's coming in ATCRBS, perhaps it is well to briefly trace generations of radar up to the present:

PRIMARY (RAW) RADAR is the original radar in which beams are sent out from an antenna and displays of energy are reflected back from these beams. This is the type of radar that shows up on the scope as aircraft skin paint returns. With primary radar any beam reflective material (ground clutter, moisture, etc.) will also evidence itself as a return on the scope, thereby making identification of aircraft targets more difficult and this system of limited value for traffic control purposes.

BASIC MARK X was the first secondary system, which in addition to the ground transponder, had an airborne receiver transmitter to transmit a signal back to the ground station. This system was developed in early 1942 to identify the aircraft as friend or foe (IFF). The present radar system is essentially the same as the BASIC MARK X. Advantages over PRIMARY RADAR stem primarily from the fact that the scope display is dependent not on energy reflections, but pulses transmitted from the airborne transponder. The big drawback of MARK X is that it does not have a capability for displaying coded displays. For the ground operator to identify MARK X returns it is necessary to present all radar beacon responses on his scope, thereby defeating the selectivity benefits of the coded system.

MARK X SELECTIVE IDENTIFICATION FEATURE (SIF) is a modification of BASIC MARK X that makes provision for transmission of coded replies. These replies can be decoded by the ground unit for presentation as a discrete display.

ATCRBS is the standard air traffic control surveillance radar system. It makes use of a 10 channel decoder to sort out only returns of those aircraft for which a particular controller is responsible. Codes are presented on the common air traffic control Mode 3/A. Civil Mode A is the same as the military Mode 3, hence Mode 3/A. (Military Modes 1 and 2 are tactical modes and are not used in traffic control.) Mode C is the designation of the mode that will be used for altitude transmissions. Mode D has been designated, but no use specified.

OPERATION of ATCRBS is by interrogation from the ground equipment and reply by the airborne equipment. Interrogation from the ground on Mode 3/A is by transmission of radio pulse pairs, 21 microseconds apart, on 1030 mc. Reply codes (ATCRBS interrogates on modes and the airborne transponder replies with codes on these modes) are formed by the arrangement of individual pulses in a 20.3 microsecond long pulse train and are transmitted to the ground on a frequency of 1090 mc. Within the pulse train of framing pulses there are information pulses at 2.9 microsecond intervals. Information pulse transmissions depend upon the airborne transponder selection setting. Presently there are 64 possible code settings from 00 to 77.

SIDE LOBE SUPPRESSION is necessary for true target identification. Whenever there is shaped or pulsed energy transmission, side energy transmissions are a common characteristic. When aircraft are close to the ground interrogator one transponder will produce multiple target displays. Suppression is achieved by transmission of extra pulses by the interrogator with the transponder using these extra pulses to differentiate the main lobe. Three pulse suppression is common in the U.S., with an additional two pulse suppression feature for overseas use.

MODE C will be for altitude information. It is intended to display with an accuracy of plus or minus 250 feet in 100 foot increments from minus 1000 feet to plus 127,000 feet. When Mode C is added more information pulses will be required. This provision is to be effected by a first pulse spacing 1.45 microseconds after the first framing pulse. This will multiply the information pulse capability by 64, making a total of 4096 available codes per mode. Altitude information will be transmitted automatically, regardless of the mode/code selection by the pilot.

OTHER CHANGES, either programmed or considered include:

A Special Position Identification (SPI) pulse that can be used with any of the codes upon request.

Selective code assignments to provide more positive identification.

A light gun with which the controller can focus the beam on a beacon target and get a readout of the target's code on a control box.

Identity and altitude information presented by the position blip on the scope.

Reduction in the number of advisories and traffic avoidance vectors.

Increased positive control capability, including high activity airspace below 14,500 feet.

Reduction in the volume of communications between controllers and pilots.

An altitude cross check between pilots and controllers.

Increased ATC efficiency in serving high performance aircraft.

Afford ATC an improved means of determining when greater vertical separation is needed due to turbulence.

Reduction in the number of required code changes.

Reservation of specialized codes for unusual situations; e.g., Code 77 for emergency and Code 76 for radio failure. (At present all ground equipment does not have the capability of picking up all airborne transponder emergency settings—when an emergency exists, to insure that the emergency is seen by all equipment within range it is suggested that Code 77 be selected as well as the emergency setting.

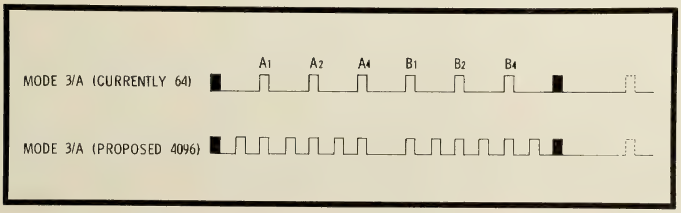
Using computors, the future holds promise that computer stored data can be matched to the beacon target and displayed on the controller's scope. In this connection, use of automatic tracking devices can monitor routine flight and make traffic conflict predictions.

Center marking of blip returns to provide safe separation in highly congested areas.

Some of these changes are already beginning to show up in the system. Others can be expected as rapidly as necessary equipment comes into use and pilots and controllers can be informed.

There is no doubt that programmed radar systems are designed to enable more efficient airspace use with increased safety. ☆

Transponder reply codes are depicted below.



MIL·S·38130 A SAFETY MILESTONE

Maj George P. Haviland,
Directorate of Aerospace Safety

A lifetime of safety for Aerospace Systems is the goal of a new Military Specification (MIL-S-38-130) prepared by Headquarters, AFSC. Bearing the usual turned-around title of "Safety Engineering of Systems and Associated Subsystems and Equipment, General Requirements For," the document will require contractors to apply safety engineering principles during design, development test and inservice changes to aerospace systems.

In effect, contractors will be required to adopt a "what if" attitude during system design and to make safety changes when the "what if" question indicates an unsafe condition.

You're probably wondering why another specification has been published in addition to the large number of specs already in existence. The answer is simple. First, until MIL-S-38130 was developed, no Military Specification on safety existed. Second, the USAF has needed one for years. The Directorate of Aerospace Safety has recognized this need partly from surveys, staff assistance visits, accident investigations and other sources. These activities have clearly shown that many systems which are now operational have safety deficiencies designed into them. No one purposely engineered a hazardous component or procedure into any system, but the fact remains that through oversight or lack of a safety influence during design, some operational systems are less safe than they should be.

It also became clear that, in many cases, when safety deficiencies are discovered after a system goes operational it is impossible to correct them. It's just too late. This is true because extensive retrofit programs in the name of safety are costly in terms of both money and time off alert status.

When safety deficiencies are found, what approach has the USAF used to avoid the hazards? Usually, the appropriate agency corrects the minor problems with minor engineering changes. The major problems are made the subjects of engineering study and new procedures are devised which *go around* the hazards. The hazards are still there, but now the probability that they will result in death or damage is reduced. With a system that is already operational, this is about all that can be done, but even this superficial type of solution is expensive.

As a result, it became evident that correcting safety problems after fielding the bird was not the way to do the job. Using a little hindsighted philosophy, it has been noted that the USAF has consistently procured weapon systems with the hope that safety would be delivered along with the hardware. It was hoped that through some magical process, operational systems would not have safety deficiencies built into them. In some cases this hope was realized, but more often than not, safety problems were accepted by the USAF simply because it was too late to do anything about them. No stones are being thrown at weapon system contractors by saying this. In fact, whatever degree of safety was received in the past came largely from the contractors motivation to turn out a good product and to create good will with the customer. Commendable as these motives are, the quantity of safety provided has all too often been inadequate.

The Directorate of Aerospace Safety therefore decided that formalized statements of safety requirements were needed. A project was initiated to see what could be done to introduce safety into some of the key USAF directives.

The 375 series of Air Force Regulations offered a fruitful line of approach, at least from the viewpoint of the USAF management effort. Consequently, changes were recommended for the 375 series which placed more emphasis on safety. These changes are being processed currently. In addition, AFR 58-4 was revised and changes to AFR 80-14 have already been accomplished. But these actions, though needed, did not make the contractor a member of the safety team and he should be the prime target since it is precisely within the contractor's engineering section that the need for safety philosophy and influence is so important.

The contractor thus became the focal point of the efforts to require safety during the design. It was concluded that a Military Specification, to be made a part of weapon system procurement contracts, was the best method for accomplishing this objective.

Before writing the specification, it was necessary to research existing documents on safety. One of the most significant contributions was in the form of a BSD exhibit (62-41), which covered safety engineering requirements during the acquisition phase of ballistic missiles. This exhibit offered an opportune point from which to begin the preparation of a Military Specification on safety engineering. It is noteworthy that BSD, which is intimately involved in missile system design and fabrication, recognized the need for formal safety requirements so early. The preparation of Exhibit 62-41 was a far-sighted effort.

So, D/TIG started work on a specification which applied only to missile/space systems. Hq AFSC reviewed the draft and then volunteered to expand it to include all systems. D/TIG agreed.

This covers the background leading up to the publication of the AFSC specification. Concerning the specification itself, it might be helpful to describe a few of the requirements it contains. Let's take a new weapon system, not yet on contract, and outline some of the applications the specification will have during the system's life cycle.

During the proposal stage, when contractors are requested by the Air Force to bid on a new system requirement, the specification requires the bidder to describe how he intends to incorporate safety into the proposed system or subsystem design. A contractor will be required to identify the safety hazards of his design as well as his program to reduce these hazards. The program is summarized in a document called the Preliminary System Safety Engineering Plan (PSSEP). It is submitted to the Air Force as part of the contractor's proposal.

The PSSEP includes safety requirements, procedures for conducting safety analyses, failure mode analyses, and actions programmed by the contractor to reduce the level of hazards identified in the system or subsystem. Contractors are also required to select the focal point within their organizations for the safety engineering effort. This will provide a single point of contact in the contractor's organization for all safety engineering matters.

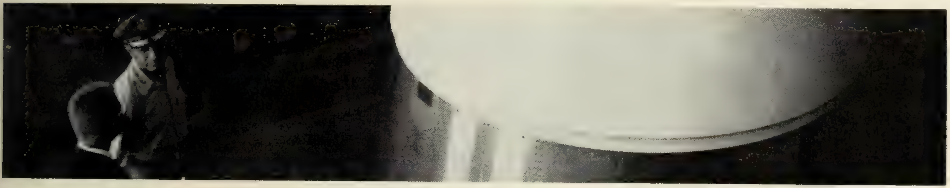
It is significant that all this occurs before a contract is awarded. This means that safety will become competitive in the sense that all bidders will include safety in their proposals and the source selection board will use safety as one of the many criteria on which a contract award is based.

Once selected, the contractor will revise his Preliminary System Safety Engineering Plan into a System Safety Engineering Plan applicable to his portion of the work. When a Prime or Integrating Contractor is designated, each SSEP will be reviewed by him and the interface safety responsibilities will be resolved. Out of these actions will come the Integrated System Safety Engineering Plan which is then submitted to the procuring agency for approval.

In the past, when MIL-S-38130 was discussed with various groups, someone usually stated an objection to the duplication of effort with similar analyses required by the Reliability and Maintainability Specifications. This is not a valid objection since the specification requires the contractor to use any data generated by these other specifications in conducting safety analyses. In fact, he is contractually obligated to avoid any and all duplication of effort.

So far, the hypothetical system has progressed through the definition and acquisition phases. After acceptance of the first operational unit by the Air Force, the Operational Phase begins. It is realized that despite the introduction of safety engineering into system design and development, there may be safety deficiencies uncovered during the Operational Phase. To apply safety engineering to every period in the system life cycle, the procuring agency (in this case an Air Materiel Area) can require its contractors to provide safety engineering covering inservice changes, modernization and up-dating programs. Much can be accomplished in the area of operational safety engineering if the specification is made a part of AFLC support contracts.

Well, that's the story of MIL-S-38130 except to indicate where it goes from here. AFSC has published it and it is now available for use by any agency. The incorporation of MIL-S-38130 into new contracts will be made mandatory by AFSC through subsequent actions involving changes to existing directives. Its applicability to existing contracts should probably be handled on an individual basis. There is a likelihood that it may become a Military Standard which, after proper coordination with other services could then apply to the systems procured by them.



MIL-S-38130 has been needed for several years as any responsible SAC, TAC, or ADC man will attest. When implemented as part of a contract, this management tool will reduce the damage to USAF systems and injury to personnel from accidents. In the long run, it will increase the mission capability of our weapon systems by designing safety into the systems before they enter the inventory.

Publication of MIL-S-38130 represents a safety milestone in the USAF. It is the result of a team effort. For the last two years, D/TIG, BSD, ASD, SSD, Hq AFSC, AFLC, SAC and the Aerospace Industries Association have been briefing it, discussing it, rewriting it, arguing about it, and finally coordinating on it. Hq AFSC is to be commended for finalizing and publishing the first Military Specification for safety engineering in the USAF. ☆

MISSILANEA

DO YESTERYEAR'S ANSWERS SOLVE TODAY'S PROBLEMS?

Maj Curtis N. Mozley,
Directorate of Aerospace Safety

The missile era, from the personnel viewpoint, is rapidly entering the second generation stage. The "old heads," who in the late fifties or early sixties formulated the policies that evolved into the operational procedures, are taking their experience from the dispatched maintenance teams and the operational missile crews into other specialized areas, i.e., Quality Control, Job Control, MAPCHE Teams, Command Posts, Training, Standardization Crews, etc. This is a normal progression in any weapon system, but it does leave a void.

The replacements to fill these shoes are, in the main, relatively inexperienced in the missile field. True, they have had ATC training, completed Operational Readiness Training (ORT) (probably in the unit), and accomplished either a quality control evaluation or a standardization check, but the experience background is yet to come.

This state in the replacements' careers is the focal point for increased concern and is the time to ponder some things. As our replacement has gone through this training, he has received basic rudiments of his weapon system. He has learned in ORT that nothing is done without a checklist. But, a checklist to the "old head" reminds him to perform in sequence certain familiar functions to accomplish a given task. To our new man, a checklist tells him step by step how to accomplish a given task.

What he is doing on these steps is mostly alien to him. He knows which switch, which valve, which gauge and what pressure, but he probably doesn't know exactly which system is being operated as he flips this switch, turns this valve, etc., or, that by following the checklist he is doing tasks safely. Are we sure that every step on the checklist is safe? Is there a chance, however remote, that we have created the checklist for the experienced man and have counted on his knowing what to expect? Or, are the checklists built so that compliance will not endanger personnel or equipment, even if our new replacement is using them? Have we developed an improper attitude that as a result of experience, we no longer need pre-task briefings? That supervision is not required any more because the task has been performed so many times before?

Commanders and supervisors take a good look at the attendees the next time you have a briefing. Are these the same faces you saw back in the installation and checkout days? Or, are there some new faces? Remember the concern we went through as the weapon system was being "de-bugged?" The folks who did the "debugging" probably aren't sitting there today. Your experience level is dropping so your supervision level has to rise. Your concern now is to safely maintain the "de-bugged" weapon system with every means you have. Take a good look at your checklists, your procedures, and your supervisors. Don't hand a new man a tool that requires experience to use. The job, any job, can be done safely with the right tools, and checklists are weapon system tools!

Initially, checklists were developed by people who were not yet experienced due to the state of the art of the weapon system. As the weapon system gained operational status, changes were made to the list as dictated by experience. Some of these changes were command authorized "one-time" changes waiting final decision to revision through the AFTO 22 system. Occasionally, the change would not be approved and this notification was not received by the using organization.

Have your checklists been reviewed recently for existence of any of these unauthorized changes? Has AFTO 22 action been taken in all cases where the review of operational procedures indicated the need due to the discovery of a hazardous procedure? Is every potentially hazardous task properly supervised? Is every TCTO verified by Quality Control to insure that it is compatible with all systems? Complacency can be catastrophic. The weapon system is inherently static, but the maintainers and the operators come and go. Our thinking then must be to have the right tools, the safe tools, for the new man as well as the "old head."

We have posed the question. Now, we suggest that commanders, MSOs, and other responsible missile personnel take a good hard look to assure that we are on the safe side of the curve. We, in Aerospace Safety, will also look into this area during staff assistance visits, surveys, and project officer visits. Our objective is to help commanders, supervisors, and missile safety personnel identify any questionable procedure that could cause a mishap. ☆

3+1=1

SMSgt Thomas B. McCall,

Ground Safety Director, Misawa AB

The arithmetic in the title would make most teachers flip, but at Misawa Air Base, Japan, it's part and parcel of the everyday routine. 3 + 1 = 1, in Misawa lingo, means Education, Engineering and Enforcement plus Enthusiasm equals Safety. This formula for ground safety has won for Misawa the National Safety Council's "Award of Honor" for the third consecutive year.

I was proud when Colonel R. C. Crawford, Jr., suggested that General McCorkle "give the award to Sergeant McCall" during the presentation ceremony. But after 18 years in the ground safety business I know *I* didn't win the award. It was every officer, NCO and supervisor on Misawa Air Base; they are the *doers;* they are the winners. For any safety program to be successful, enthusiasm must emanate from the top. The Division Commander demands efficiency from his command and spells it out when it comes to conservation of men and materiel through accident prevention.

Being charged with ground safety at this base I will, at times of peak rotation, groan and curse the exigencies of the service, for rotation means that the topnotch crews, best drivers from the motor pool, crack mechanics and other service people—all safety-minded, low accident personnel—depart for stateside bases. But the job of breaking in new hands is an operational must—as much a part of the business of the military as the hazards that are part of the industrial and business life of the nation.

Safety education of new people begins when they arrive at Misawa. Military, civilian and dependent personnel attend an orientation by the base commander, legal officer, Red Cross director, information officer, director of security & law enforcement, et al. Accident prevention in one form or another is emphasized throughout the orientation.

We Misawans feel we have the safest base in PACAF and we intend to do all in our power to keep it that way. Before you can drive your favorite clunker, two- or four-wheeled, you are given an orientation on Japanese traffic laws. The international traffic signs are explained and the base driving rules are covered in detail.

If you have never driven before you can receive "behind the wheel" instructions in one of the two dual control vehicles assigned to the Driver Education Division of Special Services. The cost is nominal and the driver instructors are AAA certified. Their instruction consists of classroom and actual driving techniques. Upon satisfactory completion, students are awarded a driver's license. Stateside insurance companies offer reduced premiums to eligible graduates of the course—one more proof that safety pays dividends. The identical course is offered as part of the Misawa high school curriculum. This highly popular course is filled to capacity.

Misawa's Transportation Division, headed by Major Edward H. Stegar, Jr., has everything from cleat-track weasels, light and medium sedans, to pickup and half-ton trucks, buses and special vehicles. These roll up more than three million miles a year. Last year they accomplished this outstanding record with only two reportable accidents.

Ask SMSgt Floyd W. Lewis, NCOIC Base Motor Pool, how they maintain this enviable record and he will tell you, "We take action on the small accidents *before* they become the big reportable type." What did they do to chop down the minor accidents? They re-trained every driver who so much as brushed against a bush. And their intensive training paid off. The result? Top drivers—fewer accidents—reduced costs.

Misawa has an Integrated Safety Council: here, problems involving flying, ground, missile or nuclear safety are resolved.

The Vice Commander, Colonel Herbert E. Ross, former PACAF Chief of Safety, presides as chairman. Council members include division and air base staff officers plus all the squadron commanders and additional duty safety officers. This assembled wealth of training, education and experience, headed by a chairman with comprehensive knowledge of accident prevention programs, makes Misawa the safest base in PACAF.

If your base safety program includes Education, Engineering and Enforcement plus the one vital E—Enthusiasm—then you've got a safety program because 3+1=1. ☆

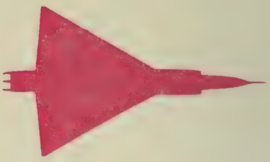
Aerobits

NEAR MISS—A recent incident illustrates as well as anything the hazards of mixing IFR and VFR traffic and the necessity for pilots to be eternally vigilant when such mixing is possible. The pilot of a C-124 cruising at 10,000 feet observed a light twin-engine aircraft at the transport's 12 o'clock position. As the C-124 overtook the smaller airplane, it became apparent that the transport would pass slightly left and about 500 feet below it. Suddenly, with no warning, the small twin began a rapid descent, passing through 10,000 feet very close to the '124 at its 3 o'clock position. The Center advised the C-124 pilot that they had no other traffic in the area. A later check with the Center revealed that a similar light twin had just landed at an airport near where the incident occurred. We can do a lot of speculating about a case like this—what if the light plane had started a left turn along with the descent? But need we say more?

WHOA, NELLIE—An H-43B was being flown on a functional test flight during which the pilot obtained permission to perform an autorotation onto a runway. He reported touchdown approximately 100 feet short of the BAK-9 barrier at 18-20 knots. Upon touchdown the throttle was rotated to the full open position but no attempt was made to stop the aircraft or to become airborne prior to reaching the barrier. The front gear passed over the barrier but the bear paws of the rear gears engaged the barrier cable deploying the cable as the helicopter rolled straight ahead. The cable held the rear bear paws on the runway, causing them to dig into the asphalt, forcing the wheels off the ground. The resulting nose low attitude motivated the pilot to respond with corrective application of cyclic control and power application. The application of power carried the helicopter farther down the runway where it struck the surface in a nose low attitude. Both front gears failed at their fork assemblies.

The accident investigation board determined the primary cause of the accident to be pilot factor—poor judgment in attempting to operate a bear paw equipped helicopter over a BAK-9 barrier.

Lt Col James F. Fowler,
Directorate of Aerospace Safety



THE F-102 AND ITS GEAR PROBLEMS—Three F-102s, three similar gear problems, three solutions, and how they worked out: A '102 pilot could not get a gear down and safe indication, even after deployment of the emergency system. It was determined that there was an electrical malfunction and the pilot was advised to turn the master switch "OFF." With all power disconnected the gear came down and locked. A successful landing followed. After the aircraft came to a stop the pilot turned the master switch on to make a radio transmission. With electrical power "ON" the nose gear collapsed and the main gear unlocked.

Several months later another F-102 pilot experienced a similar inflight incident. Based on the above case, the pilot used the procedure of turning the master switch "OFF." The gear came down and an uneventful landing was made.

In the third incident the aircraft was landed with the nose gear up, causing extensive damage to the nose and fuselage.

In incidents such as these there is normally 3000 psi secondary hydraulic pressure on the up side of the gear actuating cylinder. Where gear extension and relief of this pressure does not result from use of the normal emergency system, cutting the power source is the only means of terminating the gear up signal and relieving the hydraulic pressure on the up side to allow the gear to extend and lock.

As this specific malfunction is not covered in the Dash One, it is recommended that commanders of all units possessing F-102 aircraft make sure that their pilots are aware of the procedure, also of the necessity to not reapply electrical power once the gear has been extended by this method.

SAFE CHAIN OF EVENTS—During a runway inspection the airdrome officer noted pieces of rubber at the end of a runway. He notified the command post. Investigation disclosed that the pieces were from

a B-52 tire. The Wing had one B-52 airborne. Radio contact with the aircraft resulted in inflight inspection and the discovery that the Nr 7 tire had failed. A serious unbalanced condition existed. The Wing coordinated with the Division, and a decision was made to land the aircraft with the right aft gear retracted. Landing was normal, except for a slight right, aft list. Aircraft was shut down on the runway, placed on jacks and the right aft gear lowered. Knowledge and coordination by at least three separate groups paid off here.

HELMET RETENTION—Despite repeated admonitions in this and other safety publications, pilots still —for one reason or another—lose, discard or in some way get rid of their head gear right when they need it the most. Here's a recent f'rinstance: This lad had to make a powered exit from an F-100. Then things got sticky. The seat got tangled up with the risers and slid up into his parachute canopy and tore several large holes in the nylon. The pilot's attempts to dislodge the seat were futile and he found himself descending somewhat faster than the posted speed limit.

At this point he decided to take action which amounted to discarding his helmet and mask. Presumably he figured that this would lessen his weight and slow the descent. It cut the weight all right, about three pounds. Meanwhile, however, he kept his survival kit which weighs about 32-36 pounds. To make a long story short, this pilot apparently made out okay. Had there been a wind and the possibility of his being dragged along the ground, this lad may have sincerely wished that he had hung on to his hard hat.

We'll say it again. At all costs, hang on to your helmet! Not only is it protection during landing, but it may come in handy during over-water ejection as a rain water container, bailing bucket, sun protector, etc. Also, in the case mentioned above, there was the possibility of the seat coming loose from the canopy and striking the pilot on the head.

OXYGEN DISCIPLINE. While cruising at 35,000 on a night celestial grid navigation leg, the pilot and copilot of a B-52 aircraft noted the tail compartment low pressure warning light come on and immediately noted tail compartment cabin altitude was 35,000 feet. Attempts to contact the gunner on interphone were unsuccessful. An immediate emergency descent was made to 12,000 feet. During the first part of descent, the gunner mumbled a few unintelligible words, but did not respond to questions from the pilot.

After reaching 12,000 feet, the navigator was alerted to go aft to the gunner's compartment; however, the gunner reported on interphone at this time. He sounded confused and did not know that a descent had been made.

The pilot instructed the gunner to check his cabin pressurization controls. After several minutes the gunner was able to repressurize to 8000 feet cabin pressure.

A climb was made to 35,000 feet; the tail compartment maintained 8000 feet. The pilot decided to land and have the gunner examined by a flight surgeon. The gunner explained that he had operated the cabin pressure dump valve by mistake while attempting to operate the switch to change cockpit lights from white to red. This switch and the cabin pressure dump switch are guarded switches located close together.

This incident once again points out the extreme hazard of loss of pressure in the isolated tail gunner's compartment of the B-52 aircraft and the importance of proper oxygen discipline by the crew. Approximately two years ago a B-52 tail gunner lost his life as a result of an unnoticed depressurization of his compartment. This latest incident could very well have ended in a fatality if the pilot's "tail compartment low pressure warning light" had been inoperative. Thorough checks of this system by maintenance personnel as called for in inspection workcards are essential and, as in this case, could save a life.

Lt Col Robert P Rothrock
Directorate of Aerospace Safety

Aerobits

POLYMER FUME FEVER—Due to an engine malfunction at pre-takeoff, a C-54 with 25 passengers aboard was taxied back to operations where maintenance was performed. Since it was raining the passengers remained inside the aircraft which eventually took off 2½ hours later. During this time the APU (auxiliary power unit) located in the aft portion of the passenger compartment was operated intermittently. After level off, the passengers became ill and complained of constricted feelings in the throat and chest, muscle aches, pains and chills. When the aircraft landed, after three hours of flight, seven passengers were hospitalized, with three remaining in the hospital overnight.

The flight surgeon made exhaustive tests and established conclusive proof that asbestos tape used on the APU exhaust pipe was responsible for the sickness experienced by the passengers. Tests using smoke generated with the asbestos tape alone duplicated the sickness in test subjects. The offending asbestos tape, Stock Number 9390-618-5919, was a substitute item, and not the type (Stock Number 5640-292-6439) which is specified for wrapping the exhaust ducts of APU's. Fumes from asbestos tape, Stock No. 9390-618-5919, are toxic due to a teflon plastic filler which this tape contains.

USAF Medical Service Digest, Nov 1963

FUSELAGE FIRE—A select crew was scheduled for an ATO takeoff to be followed by instrument checks for the copilot and the copilot of another crew who was the fourth crew member on this sortie.

The ATO rack and bottles were checked during the external preflight. They were ascertained to be secure and connected and ATO circuit checks were completed during the interior preflight.

Engines were started and the aircraft was taxied at scheduled time to the runup pad near the end of the runway. Pre-takeoff checks were completed and power was advanced to 100 per cent for the takeoff roll. Water/alcohol switches were activated and at S-1 speed the ATO was fired.

Unknown to the crew, a fire developed in the aft fuselage and tail of the aircraft. After the aircraft was airborne the crew was advised by the tower operator that the aircraft was on fire. The copilot confirmed the fire to the pilot who alerted the crew for bailout. The pilot then zoomed the aircraft to an altitude of 2400 feet and ordered bailout of all crewmembers. All four crewmembers successfully evacuated the aircraft; however, the pilot suffered fatal injuries when he did not separate from his seat before ground impact.

The fire resulted from materiel failure of a bracket on the ATO rack which allowed an ATO bottle to swing around and burn a hole through the fuselage into a fuel cell of the aft main tank. Discrepancies found in the pilot's escape system included: shoulder harness loops were not connected to the lap belt, a hole in the lap belt ballistic hose allowed gas to escape before it reached the automatic release mechanism.

Corrective action taken included: all ATO racks have been inspected for deficiencies to insure that only completely serviceable racks are used on future operations, flight crew personnel are required to personally inspect their escape equipment to insure there are no visible defects due to normal wear or usage.

Even though outstanding crew procedures and aircraft handling are exhibited, seemingly minor deficiencies in escape equipment may cause flight safety hazards. ☆

Lt Col David J. Schmidt,
Directorate of Aerospace Safety

KUDOS, A-MEN

The straight-A ratings attained by the officers named here, while attending the Flying Safety Officers' Course at the University of Southern California, are fifteen reasons to anticipate continuing improvement in aircraft accident prevention.

Capt Charles W. Bradley, Cannon AFB, NMex, TAC
Capt Keith C. Kuester, Shaw AFB, SC, TAC
Capt Ellis C. Vander Pyl, Jr, Myrtle Beach AFB, SC, TAC
Capt Laurance E. Kirschner, Gtr Pittsburgh Aprt, Pa, ADC
Capt John A. Schissel, Municipal Aprt, Des Moines, Ia, ADC
Capt John E. Seaton, Webb AFB, Tex, ATC
Lt Col Claude R. Nelon, Griffiss AFB, NY, SAC
Capt John R. Ousley, Dow AFB, Me, SAC
Maj Winston R. Dole, Otis AFB, Mass, SAC
Capt Gerlad T. McCarthy, Minot AFB, NDak, ADC
Capt Keenan C. Bone, Hill AFB, Utah, ADC
Capt Walter I. Bostwick, Langley AFB, Va, TAC
Maj William R. Stack, Minneapolis-St Paul Intl Aprt, Minn, CONAC
Capt Albert L. Ferzacca, Wright-Patterson AFB, Ohio, AFLC
Capt Grant S Pyle, III, Fresno ANG Base, Calif, ADC

WELL DONE

CAPT. RALPH R. CARLOCK

319 Fighter Interceptor Squadron, Homestead AFB, Fla.

During the night phase of a tactical evaluation, Captain Ralph L. Carlock was scrambled as a wingman in a flight of two F-104s with a TAC EVAL chase. After level off at 35,000 feet, the flight was paired against a low level target. With speed brakes extended and descending through 15,000 feet, Captain Carlock, who had a total of 29 hours in the F-104, noted an engine rumble followed by decreasing EGT and RPM. Engine airstart procedures were effected with no response from throttle movements. An immediate transmission of the emergency was made and the speed brakes closed. At this point all cockpit lighting and communications were lost as both generators dropped off the line. In total darkness without emergency cockpit lighting or communications, Captain Carlock employed below 15,000 feet stall clearing procedures, stop-cocked the throttle and successfully obtained a relight and regained power and cockpit lighting at 5000 feet altitude. Engine acceleration was normal up to 95 per cent where it hung indicating a cold shift compressor stall. Again engine recovery to full power; however, under these conditions engine power cannot be reduced below 97-98 per cent for remainder of the flight and under this power condition it is extremely difficult to keep the aircraft under gear and flap placarded limitations.

Captain Carlock successfully landed his F-104A without incident after making a night weather approach while evading numerous thunderstorms in the area by applying G-loading to the aircraft to keep his speed down with the power at 98 per cent until he was over the end of the runway. The outstanding airmanship and extreme coolness that Captain Carlock displayed and complete knowledge of prescribed emergency procedures enabled him to cope with an emergency situation at night far out at sea and effect an extremely difficult recovery and landing both at night and in weather. His achievement is indicative of his high degree of professional airmanship and is a credit to the United States Air Force. Well Done!

LITTLE THINGS
mean a lot...

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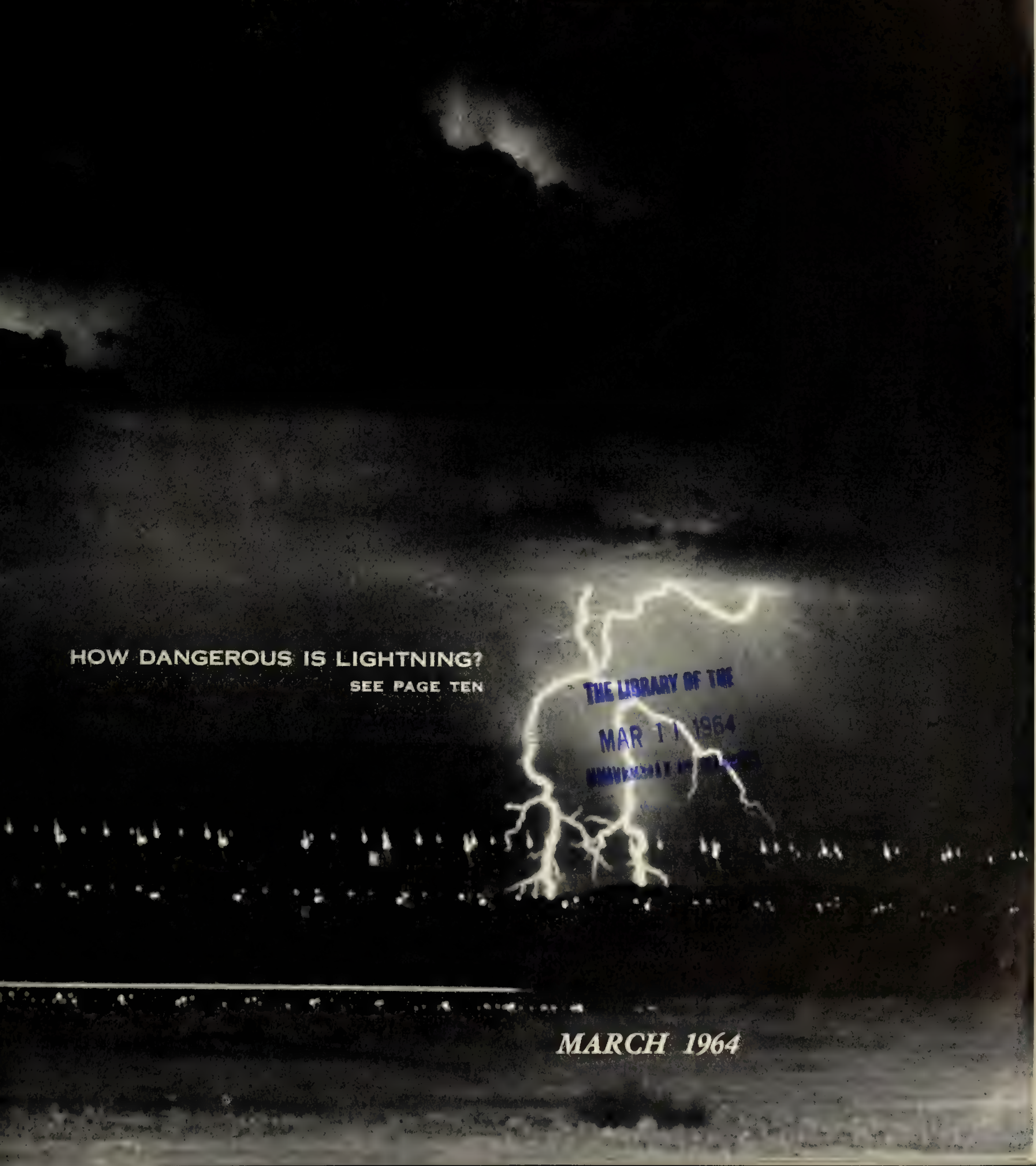
FLYS

AEROSPACE

SAFETY

UNITED STATES AIR FORCE



HOW DANGEROUS IS LIGHTNING?
SEE PAGE TEN

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MARCH 1964

Ground Safety Report For '63; Outlook For '64.

A LOOK AT THE RECORD

Colonel James F. Risher, Jr. • Chief, Ground Safety Division

Preliminary year-end accident data for calendar year 1963 reflect a favorable downward trend in most categories of ground accidents. For example, the total number of ground accidents reported was approximately five per cent less than in 1962. There was also a decrease of approximately five per cent in military and civilian disabling injuries. Experience in maintenance, supply and services, communications, civil engineering, and related industrial functions generally paralleled the downward trend.

However, total Air Force fatalities in 1963 were somewhat in excess of the 1962 total. This is directly related to a slight increase in private motor vehicle fatalities, which traditionally account for three-fourths of all Air Force deaths from ground accidents. Although this continued rise is discomforting, it should be noted that the increase (one to two per cent by present data) for 1963 is considerably lower than the 1962 experience, when the private motor vehicle fatalities increased slightly more than ten per cent over the 1961 level. It is noteworthy, too, that Air Force experience has consistently been better than the national average.

This brings us to the outlook for 1964. In past months—through safety surveys, staff assistance visits, and miscellaneous TDY visitations—we have noted an increased awareness of the ground safety challenge. It appears that more and more commanders and supervisors realize that safe operations are efficient operations, whether they be tactical, maintenance, or other support. The demands of safety are recognized as being synonymous with the demands of efficiency—involving the same people, using the same tools, performing the same tasks. Our accident files are still being cluttered with startling, sometimes ludicrous accounts of supervisory inefficiency as a principal cause factor in accidents. However, we detect a growing awareness of the primary role of *supervision* in insuring efficient performance of Air Force mission requirements in the ground environment.

The responsibilities of the supervisor—the junior commissioned officer and the non-commissioned officer—are recognized as extending beyond duty hours. Here, influence can be brought to bear upon our number one accident producer, private motor vehicle operation. Extracts from a recent *TIG Brief* outline the gravity of the problem: "... During the three-year period beginning in 1960, 1241 Air Force personnel were killed and 9100 were injured in private motor vehicle accidents. . . . A large number of the private vehicle accidents involved young officers and airmen. . . . Lieutenants and captains, comprising 65 per cent of the officer strength, sustained 80 per cent of the accident injuries and fatalities among officers. Airmen of the lower three grades, comprising 40 per cent of the enlisted strength, sustained approximately 55 per cent of the accident injuries and fatalities involving airmen. Over half of the accidents and nearly two-thirds of the fatalities occurred between 2100 and 0500 hours . . ." Accident data clearly reveals that many of these accidents involved the factors of alcohol and/or fatigue in various and usually undetermined combinations.

Again, from the *TIG Brief*: ". . . Such information is particularly distressing as it points to our past inability to cope with a problem which does not pose the same challenge or dangers as others that the USAF has mastered and kept under control. By strengthening local information and guidance programs, and supervision of local recreational and off-duty activities, commanders can prevent some of these disasters that befall our younger members. Stress should be placed on programs to strengthen their moral fiber and mold them into good citizens who can be relied upon to drive courteously and safely, and to eliminate such dangers that carelessness creates on the highways. All local supervisory personnel must take aggressive action to assure maximum quality and no weaknesses in such programs."

We believe that in 1964 the Air Force supervisor will steadily increase his influence for safety and efficiency in all operations. We believe that he will do this by giving judicious attention not only to on-the-job performance, but to the after-hours environment and activity which bear so directly on the efficiency of duty performance. ☆

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☆ ☆ ☆

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SAFETY GAIN IN '63

Year-end statistics confirm that flying operations in 1963 were the safest of any year on record.

The number of major and minor aircraft accidents was down 17 per cent from 1962. The major accident rate was 4.4 accidents per 100,000 flying hours in 1963—a 23 per cent reduction from the previous year. Numbers of fatalities and aircraft destroyed were the lowest in the history of the service.

While the number of accidents and disabling injuries involving USAF personnel in all ground activities was down 5 per cent from 1962, fatalities resulting from ground accidents were up from 560 to 575. Most ground accident fatalities result from private motor vehicle accidents during off-duty hours.

Air Force missile operations increased considerably in 1963. As a result, there was a 9 per cent increase in missile mishaps over 1962. Airlaunched missiles accounted for the increase. Mishaps in 1963 involving ground launched strategic, tactical and interceptor missiles were actually fewer than during the previous year.

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Volume Twenty Number Three — USAF Recurring Publication 62-1

THE THIN LINE OF LIFE

Early humans survived the rigors of nature with a few animal skins and primitive shelters. By so doing they testified to the strength and endurance of man and his capacity to outwit the elements. Air Force crewmembers with their modern survival equipment and training should be able to do as well. As one recent survivor said, "It was just like Stead, except there was more snow."

It's a thin line that separates life and death.

Why, in a survival situation, does one man make it and another man die? How is it that a healthy individual who is not seriously injured dies just as surely as if he had placed a loaded gun to his head and pulled the trigger? Let's examine some of the reasons that seem apparent—why one man survived even though we don't know precisely why the other one didn't.

"Follow the book. Don't panic. Apply every bit of winter survival training you can remember." This is what one recent survivor of a B-52 ejection had to say.

The pilot quoted above followed his own advice. First, he allowed his automatic timer to deploy the chute. After landing in a wooded, snow covered mountain area with subfreezing temperatures, his first action was to give his situation some thought. Having considered his problems and what to do about them, he built himself a shelter. He then inflated his life raft and, using it as insulation from the cold ground, placed his sleeping bag on it and crawled in.

Prudently, in view of the weather and the fact that it was night, he decided to stay put. He knew that searchers would be out as soon as possible so he prepared to attract them. He built a fire for warmth and placed his emergency radio inside his flying suit in order to warm and conserve the batteries. Really using his head, he decided to operate the radio only when he heard aircraft and then only on TONE in order to get maximum life out of the batteries.

Later, when he spotted a helicopter he was ready. When the chopper got close enough he used the signal mirror in his survival kit to attract the crew. When the pickup was made he was in good condition.

Now, for another case. This man accidentally opened his chute at high altitude. As a result, and because of the turbulence, he had a chilling, highly uncomfortable ride down. His survival kit, swinging from its lanyard, flopped around dangerously so he wrapped the lanyard around one leg. Consequently his leg received painful cuts. In his pocket was a small survival kit but this was lost during the rough descent. Finally, somewhat the worse for wear, he landed in the branches of a fallen tree. Even in this ordeal he kept his head. Realizing that he was probably in shock, and that warmth is a treatment for shock, he started a fire. He also survived.

These are examples of those who made it. How about some who didn't? Others, after successful ejections and apparently in good condition, left their survival equipment and perished in numbing cold. Here is a shocking contrast—some made proper use of survival equipment and survived such ordeals in excellent shape, others made little or no use of their equipment and perished.

A tragic example occurred when five men out of nine died a few years ago in a remote, frigid place aptly

called "Hell's Canyon." (Horror in Hell's Canyon, FLYING SAFETY, February 1959 and November 1960.) This crew left a warm southern base for a cold northwest destination. Dressed in summer clothing, some even without jackets, not schooled in survival methods, they were terribly unprepared for the deathly ordeal that awaited them.

"In the dead of winter some of our pilots wearing summer flying suits fly over terrain and in weather that is as bad as any in the arctic. They crank up the heater and never give a thought to what they're going to do if the fire in that stovepipe they are riding should go out." These are the words of a survival expert who conducts an outstanding survival school at his base. "That's why we really grind it into them," he continued, "so that if they do get into trouble they'll know what to do and will come back alive."

Here are some essential items that every crewman should memorize, prepare for and never forget:

After chute opening deploy the survival kit lanyard. Some reasons for this: A pilot who landed without deploying his kit broke his back. Paralyzed from the waist down, he lay 30 hours in snow before he was rescued. Another pilot broke both legs on landing. Still another bled to death from a compound fracture of the leg after landing with his kit on.

After landing take time to analyze your situation and plan appropriate action. Concentrate on what you learned in survival school, then put this knowledge to use to save your life.

Hole up. Unless you know exactly where you are in relation to human habitation or a traveled road, stay where you are. The men in Hell's Canyon tried to walk out. Five died. Last winter a crewman down in deep snow in sub-freezing temperature, stayed put and used every bit of survival knowledge he had. Next day he was rescued in good condition, even though he received an injury on landing.

Be prepared. If you have never received survival training or are vague on the subject, take the next opportunity to get this training. Know, preserve and use your survival equipment. Wear adequate clothing for the terrain and weather along your route. Here's a quote from one of our RCAF friends: ". . . the surface temperature at Cold Lake turned out to be 40 below zero! S'fact! An 80 degree temp drop on one flight. . . . In talking this over we got to mentioning as how we had sometimes seen American jocks staging through Comox (the RCAF place here) and as how we had often admired their bright plumage, but as far as we could see, the plumage looked fine for 40 above, but no good at all for anything a whole lot lower—especially if you consider an all night stint in the open such as might happen if it became necessary to leap out of the nice cozy airframe. . . ."

Don't neglect your first aid knowledge. If injured, your most important task is to stop the loss of blood. Do you really know how to put on a bandage or a splint or a tourniquet? Do you know how to give mouth to mouth resuscitation? Can you recognize shock and do you know what to do about it?

Have the equipment to attract searchers or be prepared to improvise. One survival instructor tells how he attracted help with a strip of metal foil that glistened in the sunlight. There's always the signal mirror in your survival kit—if you don't lose it. Do you know the standard symbols to be used to provide information to a rescue aircraft? And there's the radio in your kit, probably a URC-11.

Soon you will probably be equipped with an AN/URT-21 Personal Locator Beacon. This is a compact little job attached to your parachute. Since it operates automatically, it starts beeping away as soon as the chute is deployed. There's no voice—for long battery life—but a distinctive tone signal. It operates on Guard channel, 243 mc. Latest info is that procurement began in January.

One thing about this beacon: Operating on 243 mc., it can be jammed or blanked out by other transmissions on Guard, as can SARAH and other beacons operating on this frequency. Consequently, if you hear an unusual and distinctive tone on Guard, take it for granted that a locator beacon is operating, that someone is in trouble, and give the guy a chance by not transmitting on that frequency unless you, too, have a *real* emergency.

When possible, alert someone to your emergency. A MAYDAY or actuating an emergency keyer before you go over the side, crash land or ditch might provide Rescue with the few minutes needed to save your life.

There are many other suggestions that could be made. Space doesn't permit a complete listing, so a hard look at the survival manuals is a must. For those who may be lackadaisical here are a few statistics from a five-year study, 1958 through 1962, that may overcome that tendency.

- One in every ten USAF major aircraft accidents results in a survival situation.
- There are excessive delays in approximately one in three of all survival accidents.
- Fifteen preventable fatalities (during the study period) were attributed to post accident survival conditions.
- Additional training in the use of survival equipment and in survival techniques is indicated.

If at this point you have reached the conclusion that it CAN happen to you and if you wish to learn more or refresh your memory on survival you will find the following references valuable.

SURVIVAL ARTICLES APPEARING IN AEROSPACE SAFETY MAGAZINE

Winter Survival, Dec 1961; The Problem of Sea Survival, Jan 1962; Winter Clothing, and Learn and Live, Feb 1962; Chute Uses, Jun 1962; Out From Under (overwater bailout), Jul 1962; AMVER System, Feb 1963; What To Do Until the Chopper Comes, May 1963; Make the Sharks Work For It, Oct 1963; One Man's Experiences, and Arctic Survival, Nov 1963; Fallout—letter, Dec 1963.

FILMS

FTA 279d Utilization of Game; FTA 279i Fire-building; FTA 279m Medical Aid; FTA 279w Shelter; TF 1-4597 Arctic Tundra; TF 1-5309 Stay Alive in the Winter Arctic; TF 1-5310 Stay Alive in the Winter Bush.

PUBLICATIONS

- Aircraft Emergency Procedures Over Water M64-6
- Arctic, Desert, Tropics, Sea, Sea Ice M64-3
- Land, Sea, Sea Ice M64-5
- Parachute Uses M64-15
- USAF Survival Training School R-53-28
- AF Manual SURVIVAL Training Edition 64-3

Information on combat survival material can be obtained from the Research Studies Institute (ADT), Maxwell AFB, Alabama. ☆

Apparently many pilots are unaware of the poor braking action and steering effectiveness on wet runways—especially when standing puddles cover a large portion of the runway. In most cases the apparent absence of effective braking causes the pilot to suspect a brake or anti-skid malfunction. After the anti-skid is turned off, brakes are locked, tires blown, and steering difficulties encountered. An especially dangerous combination is a wet runway, a crosswind, and an aircraft that uses a deceleration chute as a braking device. The weather-vaning effect in a crosswind is considerably amplified on a wet runway and may exceed the steering capability. Jettisoning the chute may help the steering problem, but adds to an already critical braking problem.

The following extracts from actual mishaps will illustrate the problem:

A B-52 touched down between 3000 and 4000 feet on a wet runway during a rainstorm. When brake chute was deployed, the aircraft weather-vaned to the left. The brake chute was jettisoned immediately. Brakes were checked between 7000 and 8000 feet and appeared to be ineffective. Engines 1, 2, 7, and 8 were shut down since the pilot anticipated overruning the end of the runway. The pilot turned off anti-skid and applied full brakes. The aircraft began an uncontrolled slow left turn at the 9000-foot point and full right steering failed to correct the left turn. The aircraft left the runway approximately 500 feet from the end and traveled 50 feet before stopping. Cause of this mishap was attributed to reduced braking and steering effectiveness on a wet runway. The skid resulted from locked brakes when the anti-skid was turned off. An additional factor was an increase in the tailwind component during the landing roll.

A B-57 made a normal touchdown approximately 1000 feet down the runway in a very heavy rain. Braking action was very poor and there was some skidding when one brake would lock and skid before the other. Visibility was limited due to the heavy rain. When the navigator called passing the 3000-foot remaining marker, the pilot retracted the gear. The aircraft slid to a stop 1700 feet from the runway end. Brakes were checked and no discrepancies were found.

A B-52 landed on a wet runway with a 90 degree crosswind of 18 knots gusting to 26 knots. Shortly after brake chute deployment, the aircraft tended to go to the right with full left steering applied. Brakes appeared to be ineffective. The aircraft continued to the right hand edge of the runway where the chute was jettisoned. The aircraft departed the runway and came to a stop 45 degrees from the runway heading.

A B-58 was landing with a ceiling of 200 feet obscured, one mile visibility and thunderstorms. The run-

A look at bomber mishaps on wet runways provides some consideration for . . .

STOPPING WHEN IT'S SLIPPERY

Lt Col Robert P. Rothrock, Directorate of Aerospace Safety

way was wet and the brake chute failed to deploy after touchdown. The pilot attempted aerodynamic braking and normal braking with no effect. As the aircraft was approaching a lake off the north end of the runway, the pilot intentionally veered his aircraft off the runway to the right. The nose gear collapsed and the aircraft came to a stop approximately 820 feet from the end of the runway. The primary cause of this accident was materiel failure in that the brake chute failed to deploy. Also a lack of friction of dimple tread tires on the wet runway made normal braking ineffective. TO 1B-58A-1 and 1B-58-SF-1-95 were in error in that they did not contain adequate stopping information for B-58 type aircraft on wet runways.

A B-52 was landing on a runway still wet from a recent shower. The approach and landing were excellent and when the normal brake check was made after landing there was no apparent indication of braking action with anti-skid on; anti-skid was turned off and there was still no indication of braking. A decision was made to go around. After the aircraft became airborne, the additional qualified pilot on board proceeded to the forward wheel well area for a visual check of the brakes. This check verified that the left front brakes were operating normally. A second landing was attempted. After a smooth touchdown, the drag chute was deployed, brakes were checked and found to be operating satisfactorily. The aircraft started a slight veer to the right which was partially corrected by left steering. Shortly thereafter the aircraft again started to veer to the right and could not be realigned on the runway with left steering. The pilot reported his difficulties to the IP. The IP got on the controls, applied nose left crosswind crab and heavy braking. The aircraft responded and stopped on the runway. After the crew departed the aircraft they noted that the right aft gear had failed across the journal area, Nr 1 tire had blown, and all tires had flat spots and scuffing due to heavy braking action. A thorough brake check revealed normal operation with anti-skid "on" and "off."

Wet runway stopping distances as shown in the Flight Handbook may be overly optimistic as to stopping distance required. As in the case of the B-58, tire condition and tread type have considerable effect on braking action. A recent study has shown that at high speed on a very wet runway, hydroplane effect may extend the stopping distance considerably.

Perhaps the most important lesson to be learned from these mishaps is that there really isn't too much a pilot can do to prevent an accident once he has committed himself to a landing under the aforementioned conditions. Quick reaction time and proper technique may prevent a skid from getting out of control, but the only sure way to improve the braking action is to look for a drier runway. ☆

IT'S A LONG DAY

Robert W. Harrison

The cloud of dust rising far out in the Dakota hills is not from a roaming horde of buffalo. Nor is it from Indians riding across the prairie in pursuit of the bison. But a person with a sense of history has that I've been-here-before feeling as he pictures the Old West in his mind's eye.

The dust cloud follows a blue Air Force station wagon rolling along a dirt road. The occupants are two men dressed in white coveralls with blue Hollywood-type scarves around their necks. From a distance their safety helmets look like jaunty derbies. Seat belts hold them tightly in their seats. Their destination: Delta. Their job: the combat crew of a Minuteman Launch Control Center (LCC).

The men are in their third hour of what would be a 30- to 40-hour stretch of duty and travel time during which they will get little, if any, sleep. During 24 hours of that time they must remain on Alert and ready to handle any problems that may occur within the LCC or at the 10 launch facilities they will be responsible for during their tour of duty.

Within each Launch Facility (LF) is an intercontinental ballistic missile—the instant-launch Minuteman, a slim, lethal, solid fuel propelled instrument of deterence buried deep underground in a steel and concrete tube. The combat crew has the responsibility of monitoring the status of each missile by means of an extremely complex electronic network. Any malfunction in this system will appear as a light under one or more of the many plastic buttons that glow on the panel of the crew commander's console. Following is a much simplified example:

A red light appears under a certain button on the console and VRSA (pronounced VERSA and meaning Voice Recorded Signal Assembly) read out follows. (This may occur automatically or by command.) Having isolated the fault to a particular system, the crew commander then calls Job Control, "We've got a Channel 9 at Delta 5." This information is then passed to Plans and Scheduling which dispatches the appropriate team of technicians to check out the system and perform necessary maintenance.

The combat crew, with proper controls, also is responsible for launching their missiles. Perhaps even more important is their responsibility to assure that none of their missiles is inadvertently launched.

But this is not one of those dramatic stories about the awesome weapons that make up the nation's deterrent power. It's a simple story of two men, a cut above the ordinary but by no means supermen, who are representative of the many other two-man teams that man the Minuteman Launch Control Centers. They're a pair of captains—call them Jack and Bill.

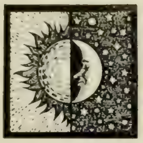
They first met when they reported to the Wing six months ago. Both had volunteered for the Minuteman program, Jack from a maintenance job at a southern base, and Bill from a fighter outfit overseas. They were motivated by the offer of an opportunity to earn advanced degrees through the Air Force Institute of Technology (AFIT) program tied in with the Minuteman. "The Air Force is increasing its emphasis on education and men with advanced degrees will have a leg up on those who don't have," they were told during an interview.

During their training period both men had given the AFIT program much thought. Somewhere Bill recalled seeing some figures that, to him, were conclusive proof that he had been wise to get into the Minuteman program. The figures said that nearly every Air Force officer had some college, that well over half were graduates and the latter figure was growing all the time. Later, in discussing the matter, Jack had pointed to the high educational standing of the young men coming into the Air Force. "A man had better get all the schooling he can, or he's going to find himself Tail End Charlie," he said. "Besides, if things continue as they have, it's going to take a Ph. D. to understand what the Air Force is all about."

Although Bill had entered the Air Force to fly and disliked giving up his job as a pilot, he now had family responsibilities and must consider his future. Where else could a man get an advanced degree while on the job and at no cost to himself? And, while enhancing his career, he'd be doing an important job.

After four weeks at Chanute and a like tour at Vandenberg, the men had reported to their present post for more training, including on-the-job practical experience. They had been among the first to be certified as combat crewmen and were assigned to work together as a team. Now, they have several months of experience behind them.

Their week goes something like this: Day 1, duty at an LCF; Day 2, duty and time off; Day 3, miscellaneous activities—school, study, training, etc; Day 4, LCF tour, the beginning of another cycle. Until recently they were averaging 90 hours a week, now they're on a more normal schedule of about 70 hours.



Time begins to drag. The night seems to inch alo

In addition, Bill has to find the time to fly between tours.

On Monday morning (this varies due to the scheduling cycle) they report to the squadron briefing room at 0715. There they are briefed on a number of items and receive the equipment and information they need for their tour of duty in the capsule. At 0730, the briefing behind them, they walk to the line of cars parked outside the hangar, find theirs, make a quick inspection of the vehicle and depart for the LCF where they will put in a 24-hour tour. The LCFs are scattered over a wide area many miles from the base and they may drive from 30 to 150 miles to get to the job. Today they will go to Delta, which is about 60 miles and two hours out in the hills. Driving time depends somewhat on the roads and today they'll have 15 miles of dirt and gravel.

At the LCF they grab paper cups of coffee from the kitchen, check with the security sergeant and ride the elevator down to the door of the capsule, a steel tank buried many feet underground. The crew they are replacing, notified of their arrival by the sergeant topside, opens the massive eight-ton steel and concrete door.

"Clear," a voice inside calls. Bill, his hands full of paper, a brief case, parka, two cups of coffee and some magazines, is too close. He steps back to avoid the door and echoes the call. Greeting the new arrivals are a pair of red-eyed individuals dressed in costumes similar to theirs. "Broughtya some coffee," Jack says. The duty crew welcomes the hot liquid that helps take some of the chill off the room. As they enter the capsule, Bill's eye catches the thermometer. 70 on the button, it never varies, but it seems colder.

Thirty minutes later the capsule door is opened and the retiring crew leaves. The door closes again on the two men who will remain in the tiny electronics-equipment filled room until another crew arrives tomorrow to take over the task of minding 10 missiles.

So far Jack and Bill have had little time to study, while on duty, for their classes in the AFIT program. They are not busy every moment, but interruptions are too frequent to permit long periods of concentration on lessons. So they don't attempt to study; instead they go into the capsule equipped with magazines and pocket books to while away what leisure time there is. Perhaps, as the Minuteman program gets farther down the road, the combat crews will be less busy and will have more time to crack the text books with fewer interruptions.

The lights on the status board indicate that one missile is on standby and automatic checkout. The log reveals that it should come back on alert in about one hour. A maintenance team is working in LF3 and should be finished and have the site buttoned up by 1430. Otherwise, everything at the moment is GO.

Traffic on the radio is brisk and every few minutes the telephone rings. Jack, crew commander, handles this while Bill, checklist in hand, makes an inspection of the entire capsule. The floor suspension system is still out of whack—three of the pneumatic cylinders read zero while the fourth is at 2000 psi. The item has been UR'd. Except for the oven being out and recurring trouble with the UHF, everything is in good order.

Although far from spacious, the capsule provides adequate room for two men. The commander's console faces, say north, in which case the deputy's console faces east. They have a four- to five-foot space for a walkway between the cabinets of electronic and other equipment. There's a tiny toilet and hand basin at one end with a curtain for privacy. As an accommodation to crew comfort, there is a cot and a cabinet containing a small oven and freezer. The cot doesn't get much use.

By 1500 all LFs are on strategic alert and the maintenance crew is on its way back to the base. Meanwhile, another maintenance crew has arrived in the capsule to work on the UHF. After they leave, Bill switches on a tape recorder that has been provided for the crew, and the soothing notes of a current hit tune fill the room. This continues for some time, then the music abruptly ends and a voice announces, "This is recurring training in the operation of . . ." They concentrate on the message; then, when it ends, replace the tape.

The phone rings. It's one of the cooks ready to bring dinner down. "What is it?" Jack asks. "Okay, send him down." Turning to Bill, "Cookie is on the way with the goodies."

Again the ponderous door opens. "Clear." "Clear," a voice echoes. The cook starts through the short tunnel to the capsule with trays of food. He doesn't duck far enough however, and his head strikes the sharp steel lip of the tunnel. He bounces back with a moan and Bill catches the trays just in time to keep dinner from landing on the floor. "Now you know why the hard hat," he admonishes the cook.

With the cook out of the capsule and the door again closed, the two men settle down to dinner. "Well, we're coming up in the world—steak," Bill observes. "Sure beats that chili goop and hot dogs we had last time we were here."

Dinner over, the men engage in small talk for awhile, then Jack finds himself busy with red lights on the console announcing outer security violations at two LFs. "The jack rabbits must be hoppin' around," he observes. Meanwhile he has alerted security topside to dispatch a strike team to the sites to check out the trouble. Their arrival and penetration of the launch facili-

e a crippled turtle. There are continuing security alarms . . . .

ties cause more telephone traffic which continues for several hours. A stiff wind has sprung up which results in many different reasons for the security alarms to sound off—someone, one of the maintenance men at LF3, had left a metal cover loose on a box. This, blown by the wind, was causing repeated alarms from the site.

The men in the capsule recall past incidents when the alarms had been deliberately set off by juveniles throwing rocks into the enclosure. Another time an unidentified individual had fired several shots into an LF enclosure. An AP stationed on watch had been endangered.

Time begins to drag. The night seems to inch along like a crippled turtle. There are continuing security alarms, a couple of exercises announced by radio that cause the men to go to their code books, VRSA readouts when red lights indicate trouble of some kind in an LF, chatter on the radio, telephone conversations with topside security and patrols at the LFs. In between, the men read in snatches from magazines. Bill fiddles awhile with plans he is drawing for a tool shed he intends to build when he has time. Finally, he gets up and paces the floor for a while. "Wonder who designed these chairs?" he asks, rearranging a blanket he had folded on the seat. "Without a doubt they're the most uncomfortable things I've ever had to sit on."

"Wish we had some coffee," Jack said, examining an electric coffee maker atop the freezer cabinet. "Where's the cord?"

"They took them all out—can't make coffee anymore," Bill replied.

"Why not?"

"I don't know. Somebody said something about the pots not being shielded and maybe they could cause trouble with the electronics. Guess we'd better start bringing a thermos."

At 0515 topside calls to say that the cook is getting on the elevator: breakfast is on the way down. While they are eating, Bill points out that he never has become time-disoriented. "I thought maybe I'd lose my time bearings. So far I haven't, but maybe if we were down here for a week, or at least several days, we'd lose track of whether it was night or day or even the day of the week."

"Have you heard about the new idea somebody's got on scheduling?" Jack asked.

"No."

"Well, the way I get it is that, if we can get an additional crew per squadron, the schedule will be changed so that we don't spend more than 12 hours down here. We might have to stay here at the facility for three days, but we'd have some off time, shorter tours in the capsule, and three days off between tours."

"Sounds like a good idea," said Bill. "That would give us a chance to sleep, study, read and get out doors for a little exercise. And think of all the miles we'd save on those cars. That might even pay for the extra men."

They discuss the idea for awhile, then Jack frowns. "One problem is our eat-sleep-work cycle. People get pretty used to the 24 hour day, regular meals and time for sleep. We might get all fouled up. I hear that some airline crews, especially on overseas flights have a hard time adjusting to a lot of irregularities in work and rest time, not to mention eating. Half the time they don't know whether to expect breakfast or dinner."

"That's something the docs will have to figure out," Bill replies, "but how about the school program? They'd have to work out something that would fit with classroom schedules."

Finally the clock begins to nudge past nine. "Hope those guys are on time, there's rain between here and the base," Jack announces.

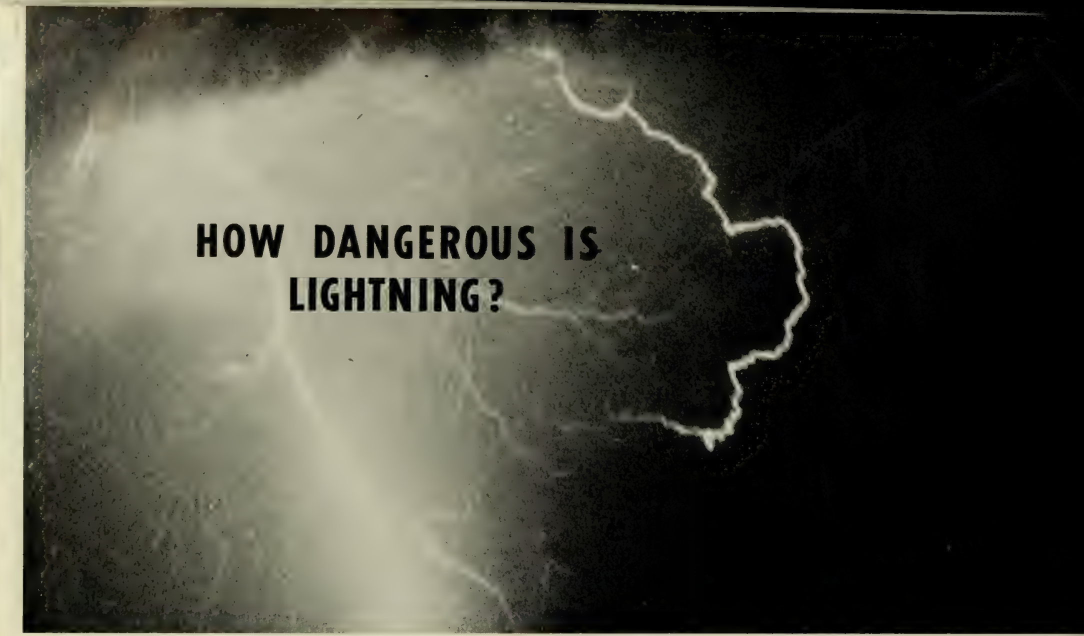
At 0945 the command post calls to say that the replacement crew has had a flat tire, they'll be late.

Eventually the new crew arrives. Turnover accomplished, Jack and Bill ascend to the light of day, coffee and the long ride back to base. Bill, driving this leg, snoozes off momentarily and has to be prompted by Jack. This was something they have been cautioned about in every safety meeting. The man not driving must stay awake to observe his partner. Fatigue is their worst enemy during this long drive home.

The men drive through the gate at 1300, check in and head for home and an afternoon nap. Sometimes sleep comes easily. Other times it won't come at all, and the futile chase for oblivion is finally given up and the man reluctantly rouses himself to putter around the house or take care of some postponed chore.

Time moves fast and good budgeting of the available hours is a necessity. During the next two days Jack must take a physical, Bill has to get in some flying. Both men attend classes, study for a forthcoming examination, attend commanders call, a safety meeting and a training session. This leaves them with a little spare time for shopping with the family, attending a movie and playing with the kids. (There are variables that may change the picture. Occasionally a man may find himself with considerable free time. Then he may be called for extra duty as a replacement for a man on the sick list, or, as recently happened, the wife of one of the men was having a baby and Bill was called to fill out the man's tour in the capsule so that the new father could get to the hospital.)

The fourth morning finds them meeting at the coffee bar downstairs from the briefing room. The time is 0710. "We'd better get upstairs, the briefing starts in five minutes," says Jack around a donut in his mouth. "Looks like snow and today we go to Tango. That 40 miles of dirt road is for the birds." ☆



HOW DANGEROUS IS LIGHTNING?

PHOTO BY DON DOWNIE

Lt Col Ferd J. Curtis, AWS Liaison Officer
Directorate of Aerospace Safety

Recently there has been renewed interest in the significance of lightning as a hazard to flight. To best answer the question, "How Dangerous Is Lightning?" let's look at the Air Force record. In this way conclusions can be based on facts.

During the five year period from January 1959 through December 1963 there was one major Air Force accident in which electro-static discharge was the primary cause. In this case a pilot ejected from an F-102 after a discharge blew the radome and pitot tube off causing loss of instruments and control difficulty. In only one accident was lightning strike or electro-static discharge credited as a contributing cause.

Reporting procedures do not require reports on all incidents and it is fair to assume that many lightning strikes have been experienced where little or no damage resulted. However, during the two year period ending in December 1963 there were 66 reports of lightning strikes or electro-static discharges. In most of these damage was confined to pitting or discoloration of the extremities of the aircraft, such as wingtips, radome and vertical stabilizer.

Information available does not, in all cases, differentiate between a natural lightning strike and an electrostatic discharge. Therefore, no distinction is made in the following statistical discussion.

DAMAGE

Damage reported in the 66 inflight lightning strikes varies from skin discoloration to superficial skin damage and disruption of electrical systems. Pitting and discoloration of nose, wingtip and tail surfaces occurred in 41 incidents. The incidents of pitting occurred in large transport and bomber-type aircraft.

Radomes are particularly susceptible, and were involved in 22 incidents. Damage varied from pitting to complete loss. However, radar became inoperative in only two of these cases. One or more radios became inoperative in six cases, of which four were due to antenna damage.

In 11 cases more extensive damage resulted. The most significant was a C-130 pylon fuel tank aft section rupture when residual fuel was ignited and fuel burned for several minutes. Fabric control surfaces received rips that required repair or replacement in four cases.

Systems malfunction resulting from a lightning strike occurred in 12 incidents. The most serious was disruption of power in three engines of a C-124 due to temporary malfunction of magneto switches. Target darts were inadvertently jettisoned by firing squibs in two F-100 incidents. Airspeed systems were affected in three cases. Magnetic compass and directional gyro malfunctions occurred in a flight of two F-101 aircraft.

Figure One shows a damage breakdown. It includes more than one damage type in a single incident. In four incidents reported there was no damage.

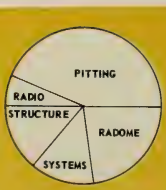


Figure 1.

OCCURRENCE

A comparison of altitudes above mean sea level at which aircraft were operating when lightning strikes were reported shows maximum reports in the 5-10,000 feet area with a sharp drop in reports above 20,000 (Figure 2). It may be of interest to note that nine of the 11 lightning strikes reported on B-52s were below 20,000 feet.

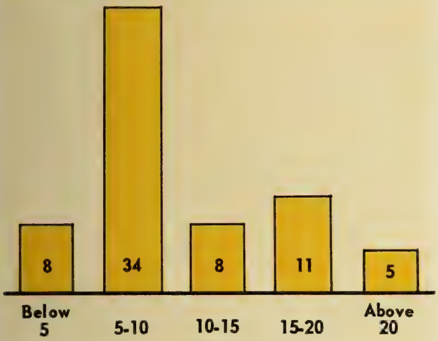


Figure 2.
Altitude (thousands of feet)

AIRCRAFT TYPE

Lightning strikes occurred to most aircraft types with the B-52 receiving the most (11), closely followed by the C-124 (9) and the C-54 (8). (Figure 3.)

Most of the lightning strikes reported by single and twin-engine jet aircraft occurred during climb and in no case was metal skin pitting reported. These aircraft were subject to loss of tow targets, tip tanks and damage to pitot tubes.

Aircraft	Incidents
B-52	11
C-124	9
C-54	8
C-118	6
F-100	4
C-119	3
C-133	3
F-101	3
B-47	2
B-57	2
C-135	2
T-33	2
F-102	2
F-105	2
C-130	2
C-97	1
C-47	1
B-50	1
F-89	1
F-104	1
	66

Figure 3.

SEASON

Incidents were reported in all seasons with a maximum in the spring and a minimum in the fall. (Figure 4.) Many reported incidents occurred in atmospheric conditions where natural lightning was not observed and does not normally occur. These were most likely electro-static discharges and generally occurred to large aircraft flying in clouds or precipitation.

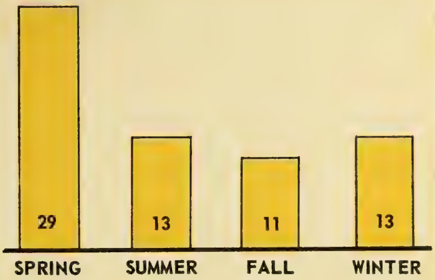


Figure 4.
Season

BRIEFS

Major Accident. F-102 pilot was at 4500 feet during instrument approach, when a ball of fire was observed in front of the canopy, accompanied by an explosive noise. The airspeed indicated zero and the attitude indicator was tumbling. The pilot experienced control difficulty and ejected. The radome and pitot tube were found to have been separated from the aircraft by an electro-static discharge.

Incidents. A B-52 had electro-static discharge while cruising on a low level navigation route at 4000 feet. Flight conditions were in-and-out of clouds with light sleet and snow. A streak of light was observed in front of the aircraft followed by a blue and red fireball about four feet in diameter. All systems were normal after discharge. Damage was a seven-inch hole in the radome and burning of the antenna in the right wingtip.

A B-52 was cruising at 9000 feet on a low level navigation route when a cloud-to-ground lightning strike was observed directly in front of the aircraft. Weather conditions were: overcast clouds with light rain. All systems appeared normal and the mission was continued. After the aircraft landed fuel was observed leaking from the aft section of the left external fuel tank. Inspection revealed a one-fourth inch hole in the tank and three other arc blobs of metal located horizontally along the outer portion of the tank.

C-130 cruising at 7000 feet, circumnavigating thunderstorms, was struck by lightning followed by one loud and one muffled explosion. Flames were observed outboard of the Nr 4 engine and trailing to the aft section of the fuselage. Flames disappeared after two minutes total burning. Inspection revealed that the aft cone section of the right pylon fuel tank was blown off by an explosion within the tank. Pitting was found in both wing tips and outboard extremities of both

HOW DANGEROUS IS LIGHTNING?

continued

ailerons. Only normal residual fuel remained in the pylon tanks at the time of the incident.

A C-135 was climbing at 285 knots indicated through 4000 feet. An explosion was heard accompanied by a slight jolt and a lightning flash at the left forward portion of the aircraft. Sound level increased and held proportionate to airspeed. A jagged hole four inches in diameter was found on the left side of the radome about 12 inches from the nose. Also, a static arrestor was burned off the right wingtip leaving a hole five inches long and one and one-half inches wide. Weather was continuous clouds with moderate rain.

A flight of two F-101s was making an instrument departure through thunderstorm activity. At 5000 feet, both aircraft were struck by lightning. Loss of magnetic compasses, directional gyros, and radome damage resulted. Both pilots experienced mild electric shock.

A C-124 was cruising at 10,000 feet in light to moderate turbulence with no lightning observed. Areas of severe weather were circumnavigated visually and through use of radar. St. Elmo's Fire was observed followed by a blinding flash in the cockpit. The lightning passed through the aircraft, smashing overhead cockpit windows, burning out numerous lights and radio components, and interrupting power in three engines. Power loss was due to popping of the magneto switch pins to the OFF position, possibly the result of heat generated by arcing in the switch case. Power was regained by returning the magneto switches to the ON position.

A B-47 crew observed St. Elmo's Fire on the nose section followed by an electro-static discharge. The incident occurred during departure at 26,000 feet in haze above broken cumulus clouds. There was no damage.

CONCLUSIONS

Lightning strikes and electro-static discharges frequently occur to Air Force aircraft. Damage resulting from these incidents is usually negligible. Isolated cases indicate that structural damage does occur but rarely results in an aircraft accident.

Lightning strikes occurred most frequently below 10,000 feet and rarely occur above 20,000 feet.

Reporting requirements and lack of exposure statistics by aircraft prevent a close comparison of susceptibility by aircraft type. There is some indication that lightning strikes and electro-static discharges are more likely with large aircraft and result in damage greater than with smaller aircraft.

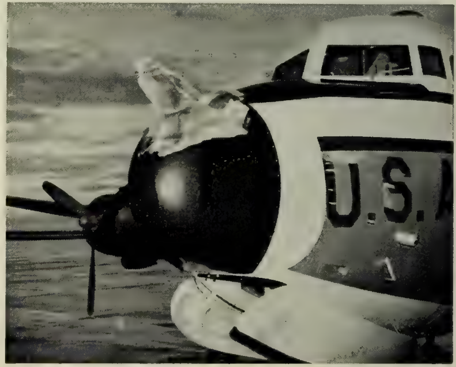
Lightning strikes or electro-static discharges occur in all seasons with a maximum in the spring and a minimum in the fall.

Lightning strikes are among the most startling phenomena an aircrew can experience. They are usually accompanied by explosive sounds and blinding flashes of light. Historically, the evidence shows they are rarely dangerous, but aircrews should recognize the hazard potential.

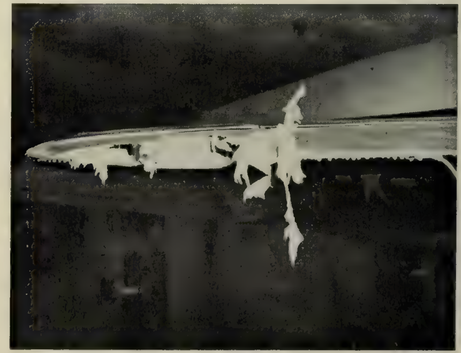
RECOMMENDATIONS

Flight handbook recommendations, such as turning cockpit lights up bright, should be followed. Better yet, avoid all areas where lightning strikes are most probable. Other weather phenomena of greater hazard to flight safety—such as extreme turbulence and icing—are frequently associated with areas of greatest lightning prevalence.

Report lightning strikes and electro-static discharges in accordance with paragraph 29, AFR 60-16. Inflight reports should be given to a Military Metro or Flight Service Station. Reports may be given to the ATC controlling agency when conditions do not permit leaving ATC frequency. After landing, the pilot is required to complete an AF Form 1228, "Aircraft Hazardous Weather Report," available at the weather station. The forecaster will assist, and completion is quite painless. Information obtained from these reports will be used to develop techniques in predicting unusual weather phenomena. ☆



Lightning damage to radome of C-54



Same plane received serious damage to horizontal stabilizer

FAA ADVISORIES

Robert L. Terneuzen, FAA Liaison Officer • Directorate of Aerospace Safety

RADAR ENROUTE PENETRATIONS. Many words have been written on this subject and, as with many new air traffic procedures, there are loopholes that cause misunderstandings between pilot and controller. Let's try to clarify a few right now.

First off—it is no longer necessary for a pilot to request "JAL Enroute Penetration to Patushnik AFB."

FAA has eliminated the requirement for the jet pilot to advise if he possesses low altitude charts. This will be reflected in a forthcoming revision to Planning Document, Section II, page 19, paragraph IV A-3 and 4. So that you'll better understand a few of the rules the controller works with, here they are—in condensed version:

1. An enroute penetration shall be authorized only when it will expedite the movement of the aircraft from an enroute altitude to the final approach without execution of maneuvers depicted on the JAL chart.

2. The controller possesses complete discretion for the provision of this procedure and his reason for disapproving a request for this service is not subject to question nor need it be communicated to the pilot.

3. When an enroute penetration is initiated by the controller, the pilot shall be advised of the controller's intent. NOTE: It remains the pilot's prerogative to elect to conduct a published high altitude penetration instead of an enroute penetration.

4. When an enroute penetration has been authorized, it shall not be terminated without the consent of the pilot except as required by radar outage or emergency situations.

5. Prior to issuing an enroute penetration clearance, the controller shall transmit:

a. Current weather at locations where the official weather is reported as being at or below the highest circling minima established for the airport concerned.

b. The current Runway Condition Reading (RCR) to Air Force and ANG Aircraft. RCR information will be provided and updated to centers, towers and Approach Control facilities by Air Force Base Operations Offices at airports not having FAA service.

6. Clearance limit assignment shall be to a navigational aid/fix depicted on the JAL chart from which a jet penetration can be conducted in the event two way communication failure is experienced.

7. The pilot shall be advised of his position in relation to the clearance limit when descent or penetration clearance is issued. In the event radar vectors are required which will take the aircraft off the previously assigned non-radar route, advisories shall be issued giving the position of the aircraft with relation to the clearance limit or destination airport, as appropriate.

8. The distance from the destination airport that penetration clearance should be issued can be determined by adding the number 10 to the first two digits of the flight level; e.g., an aircraft at flight level 370 should start descent approximately 47 miles from the airport of intended landing (37+10=47). NOTE: The above procedure is based on a rate of descent of 4000 to 6000 feet per minute.

Now that you understand a few of the controller's responsibilities, it is also necessary for the pilot to understand the necessity of explaining to ATC the handling he is requesting in connection with the "Radar Enroute Penetration."

When making your request, include the *type* approach you wish to make, i.e. "Handoff to Patushnik GCA" or "Radar vector to Patushnik ILS final approach course Runway 31," or "ASR approach to Patushnik Runway 31." Also, cross check your radar position with VOR, ILS, etc.

To wind up—let's just say that should a situation arise with which you are unfamiliar, "for your own safety *ask questions*."

HOLDING PATTERNS. Commencing 1 March the revised IFR aircraft holding pattern procedures implemented by the FAA in January 1962 are the sole basis for providing protected airspace for holding patterns.

VOR IDENTIFICATION. FAA has completed plans to make a change in voice identified VOR stations. Instead of hearing "Coolstone Omni" you will soon hear "Coolstone VOR"—or "VORTAC" and in a female voice, yet!

ROSES. On 15 November 1963 Mr. Harold D. Garman, a March RAPCON controller, very likely averted an aircraft accident. A T-33 was departing Norton AFB during IFR weather (400 feet ceiling and one-half mile visibility in light rain with cloud tops reported at 12,000 feet). Shortly after takeoff, a right turn was started to comply with the ATC clearance. Due to a 50-degree discrepancy in the primary compass system, the turn was stopped short on a heading that would have taken the aircraft into mountains. Mr. Garman noted the error on his scope and promptly steered the pilot to a safe heading. ☆

ON GUARD

ATTITUDE! "Somehow if you can get every man in the organization to realize that what he does will make or break a mission—may mean a pilot's life . . . that's possibly the best accident prevention insurance in the world."

This is the conviction, expressed in varying ways, but the underlying, inescapable conviction of members of the ANG's 163rd Fighter Group (AD), Ontario, Calif.

One of the best ways of improving any operation is to examine a similar, highly successful one, then apply practices and procedures that are paying off. It was with this purpose in mind that activities of the 163rd were observed and its people questioned.

"Applying 66-1 concepts and making the system work, this is the simplified explanation of our maintenance concept." So said a Chief Master Sergeant in the glassed-in Workload Control Room from which all ramp activities can be observed. He should know; he has been on the job since before the squadron was called to active duty for Korean service in 1950. He and another CMSgt seated nearby readily admitted that a nucleus of permanent men helps, but they hastened to stress the attitude aspect, one saying, "These people are here because they want to be—for many it's their bread and butter, and for all, the best they can contribute at all times is their minimum fair share."

The Group's Fighter Squadron, the 196th, flys F-86s—not the most forgiving aircraft in the world. And there was a note of pride in the voice of the maintenance squadron major who pointed out that these birds are now 13 years old. They don't look it. Obviously, a lot of people do care. The fire control system with its intricate radar gear probably constitutes the biggest maintenance headache, but it's vital to the mission, and in-commission rate is high.

How long are 781-2 writeups carried forward? One day. Occasionally two days, but never more unless there is a delay in obtaining a part. One reason is that maintenance technicians don't hesitate to look in the snack bar, the ready room, Ops, anywhere in the complex if they have to locate the pilot to get a better briefing on the squawk. As one supervisor explained, one or two questions and the technician may be able to eliminate a three hour checkout of a system. In fact, the pilots have caught on and usually, when there is a maintenance problem, will make it a point to personally debrief the specialists.

The wavy contrails that these part-time flyers draw across the Southern California sky could lead the uninformed to think that this is a real fun assignment. Not so! Hang around the fighter squadron for a few hours and it's readily apparent that this is a serious job performed by skilled specialists. They may be airline pilots, insurance salesmen, clerks . . . you name it; but while on duty at Ontario they are all Air Force professionals with a serious mission to perform. The 196th jocks can never forget that frequently there are more than 100 passengers on board the commercial jets that go into and out of busy Los Angeles International; and the climb and descent corridors for the fighters have to share this airspace. In addition, the jet runway at Ontario is on a direct line with the instrument runway for Norton AFB and intersects the extension of the March AFB runway. To complicate the problem even further, visibility in the lower altitudes is usually at or below VFR minimums in smog. Here's motivation to stick to departure and arrival corridors! Even this isn't all—neither smog, nor anything else deters the hardy California lightplane pilots from buzzing around in the valley like so many multicolored bugs.

The Sunday Morning Confession—this might be a fitting title for the practice the Ops officer credited as

another important accident deterrent. Any pilot who has had an experience which could have resulted in an accident is expected to get up in front of all the other pilots and tell what happened. The key here, as pointed out by the Ops officer, is not to levy blame or criticize (we all make mistakes occasionally) but look upon such confessions as tools that may save the lives of the 35 to 40 other pilots in the room. As a major said, "It was embarrassing telling of the time I punched off my tanks out at sea without verifying I had enough fuel to get back, but I felt better for the telling."

Personal equipment. It's all hung on special racks in a PE room. No one enters without the combination. Two full time PE specialists are responsible for maintaining everything in top condition. Chutes, life vests, helmets and masks are all in orderly rows in a well lighted, spotless room. There's no escaping the impression that everything kept here is as safe as dedicated men can make it.

Another impression—this obtained from command level—there's always an effort to make sure every man knows the "why" as well as the "how" of his job. All support personnel are briefed on what goes on in the cockpit from the time the yellow-marked fighters break ground until they have completed climbout, followed GCI instructions, made their intercepts and are recovered. When a man knows, in detail, his unit's mission, and especially that his contribution fits in and is necessary for success, he is bound to have a little more incentive to do the best job he possibly can.

What about the FOD problem; especially when the responsibility is limited to the squadron ramp and the taxiways leading to it? The rock on someone else's taxiway is just as damaging as any other, and there is nothing to prevent frequent, careful inspections of all areas used. A little extra cooperation—the willingness to contribute a little more than your fair share is a good technique with which to win friends and influence people who can help. As to FOD, it doesn't matter what it is, where it comes from or who is to blame; what matters is keeping foreign objects out of intakes and cockpits. Careful tool checks, not wearing caps around running engines, prominently placed posters; these are some preventatives employed by the 163rd Fighter Group.

Things like morale and pride are important in the accident prevention program of this ANG outfit. These are underlying attributes, easier to sense than define. Members of the 163rd Fighter Group are in it because they want to be, not because they have to be. They remember that to get in they had to sweat out a waiting list, and that there are always others anxious to take their places if they don't do their job well. These Guardsmen maintain a 24 hour alert as their contribution to the air defense posture of the Southwestern U.S. Their minimum obligation is two fighters airborne within five minutes, two more within an hour; quite an accomplishment for a total of 40 pilots, the majority of whom hold down full time civilian jobs. To do this, month after month, without accident gives the pilots and all their support personnel reason to be proud.

The payoff comes when boring along at night high over the Sierras. The best survival gear is not the chute on your back or the survival pack you're sitting on, it's an airplane made dependable by top ground support together with the know-how to fly the assigned mission. ☆

From an overseas safety publication—in an article titled Tailplane Icing—comes the following information on . . .

HORIZONTAL STABILIZER ICING

After some incidents which occurred in icing conditions, experimental investigations have been made into the effect of ice formations on the horizontal stabilizer leading edge. It is known that in extreme cases such formations can lead to difficulties in control.

The serious cases occur with a sharp "horn" shaped ice formation (see diagram)—the shape is more important than the amount—which causes separation of the flow on the underside of the horizontal stabilizer; this alters the pressure distribution and therefore the aerodynamic forces acting on the elevator.

Whether such separations will occur or not will be determined by many factors, such as speed, local angle of attack of the airflow at the horizontal stabilizer and the precise nature of the ice formation, which cannot of course be predicted.

The angle of attack at the horizontal stabilizer is the sum of

- the setting of the horizontal stabilizer relative to the free air stream, and
- the deflection of the free air stream due to the lift generated by the wing: this is termed the downwash.

The diagram shows that the horizontal stabilizer setting relative to free air stream is normally negative (nose down) and this angle increases with increasing nose down aircraft incidence, i.e., with increasing forward speed or with lighter weight. The downwash angle depends on the lift distribution along the wing and, in particular, will increase as flaps are progressively lowered.

Flap lowering also causes a rearward movement of the point through which the lift may be said to act on the wing, so that a higher downward load is required on the horizontal stabilizer to prevent the nose from dropping and this is provided to a greater or lesser extent by the increase of downwash.

Flow separation on the lower surface as a result of leading edge ice will do two things:

- It may cause the elevator to be pulled down.
- It will cause more UP elevator movement to be needed to compensate for the decay in horizontal stabilizer lift.

These two effects combine to produce a pull force which may reach a very high value in a badly iced up condition, and in an extreme case, say after increasing the flap angle, it may be impossible to recover control without loss of height and considerable effort.

An investigation has been made concerning a reported airline incident where, on lowering the flaps to the final-approach setting, an aircraft developed a nosedown attitude which required considerable manual effort to overcome. After some subsequent difficulty in maintaining the desired approach attitude, the pilot was able to continue the approach and accomplish a safe landing. It is worth noting that the final-approach flap selection had been made at the maximum permitted airspeed for that setting.

External inspection of the aircraft—immediately after landing—revealed the described horn-type ice formation along the tail surface leading edge, the fin and the outboard sections of the main-planes.

The amount of ice understandably surprised the pilots—for the following reasons:

- The sector concerned was of only 18 minutes duration.
- The cloud layer at departure and destination airfield was relatively thin (3000 ft or so) and well defined, affording good contact conditions below its base and clear air conditions on top during the cruise phase of the flight.
- The pilots had inspected the wing leading edges at the top of climb and established an ice-free condition.

Although power-plant anti-icing had been in use throughout the flight and windshield heaters also in continuous use (and switched to 'High' during descent), the L/Edge anti-icing system was not used for the very simple reason that it was considered unnecessary.

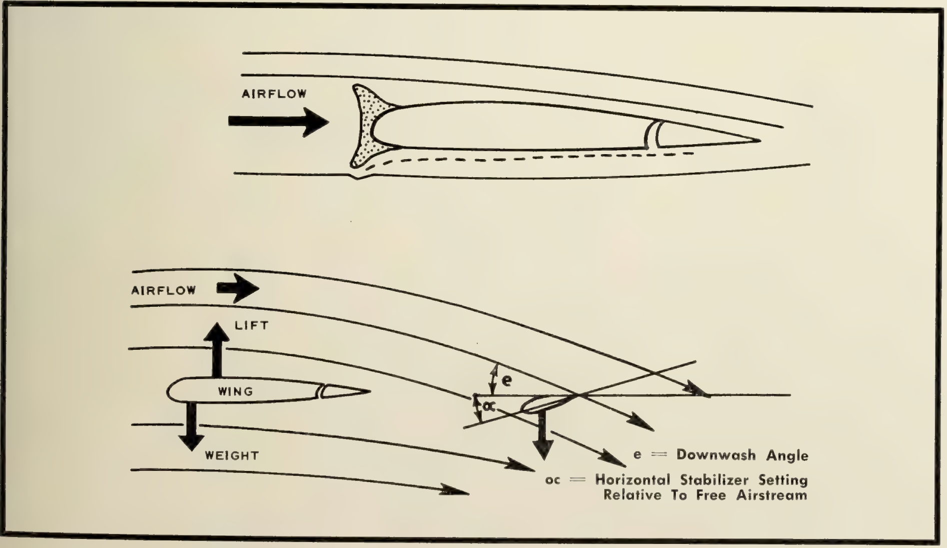
CONCLUSION

Ice can form extremely quickly and, in the case of the horizontal stabilizer, it could reach hazardous proportions in the approach phase without any prior evidence of its presence in the clean configuration.

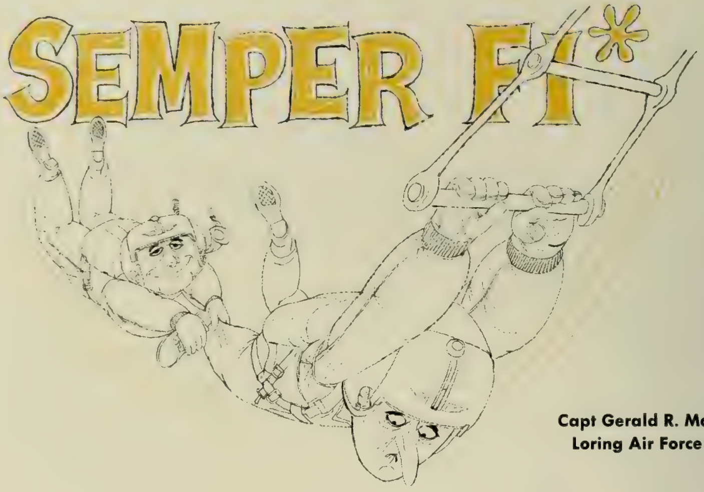
Where the use of aircraft anti-icing systems is concerned there is ample world-wide evidence of the fact that pilots tend to rely on personal judgment. It must now be emphasized that the pilot cannot always be aware of the presence of ice on his aircraft, especially the horizontal stabilizer, not to mention the fact that the shape of any accrued ice will be only one of an infinite variety. The moral, therefore, is simply this:

In the interests of flight safety, pilots should make the fullest use of all available anti-icing systems whenever ice is present or likely to be encountered even for a short time. Modern anti-icing systems are extremely effective and, when properly used, will prevent the ice formation described in this note. ☆

Flight Safety FOCUS


AIRFLOW
AIRFLOW
LIFT
WING
WEIGHT
e
α
e = Downwash Angle
α = Horizontal Stabilizer Setting Relative To Free Airstream

SEMPER FI*



Capt Gerald R. Malmgren (ADC)
Loring Air Force Base, Maine

****an old Marine axiom meaning "pull up the ladder, Jack, I'm aboard."***

Our hero and Joe, the cool copilot, have departed the east coast for Scott AFB, Illinois. They have been delayed waiting for fuel, for a power unit, an ATC clearance and clearance on the active. When they take off, their clearance for weather has expired by five minutes. Ten minutes before their takeoff the weather for Scott has been changed drastically. This change is not relayed to the pilots before their takeoff and no effort is made to forward them a weather advisory while they are enroute.

The pilots have calculated for a moderate headwind during the climb but their first checkpoint finds them far behind their time and fuel schedule. They write this initial error off to mutual mistakes by themselves, weather service and Lockheed. The clear air at flight level 320 is unaccountably crowded with clouds so our hero presses on to a higher altitude. The briefing indicated the most adverse winds to be in the middle thirty thousands so the climb is continued to flight level 400.

At this lofty stratus they find the peaches to be soggy and the cream curdled as they continue, despite inflight revisions, to fall behind in time and fuel. Twenty minutes from destination hero, by diligent use of his rose colored pencil, figures they can make it legally and theoretically.

The unexpected cloud layer at flight level 320 and the adverse winds at cruising altitude have whispered nasty things about weather into hero's ear, so he calls well in advance for the Scott weather. The report he receives is the same foul news he should have known before he took off. A few more rungs of Jack's ladder are pulled up when hero is advised that three aircraft have already made missed approaches at Scott and are on their way to their alternates.

Now hero is a 60-16 lawyer from way back and his alternate on the form is a debutante's stone throw from Scott. A hasty glance at the chart finds Sewart AFB to be his best bet so they immediately alter course for Nashville. Credit hero with a rung or two.

On the way to Sewart hero searches for, but can't find, the letdown book for that area. He hadn't checked prior to the flight and someone has removed it. Another rung gone. Happily enough, for the moment, hero learns that Joe has a letdown book so he tells him to handle the radio and the navaids and hero will direct the air machine.

Extreme radio difficulty is encountered on the way to Sewart and hero notes that Joe is saying "Stewart" instead of "Sewart" so he corrects him over the interphone. They finally contact Center control over Nashville and Joe asks for a "Stewart" VOR approach. Center denies this request but they don't tell our crew that Sewart doesn't have a VOR approach nor do they correct Joe for saying "Stewart" again.

Hero doesn't know that Sewart has no VOR Approach. He doesn't know that Joe has a crummy mask. He does know that the cabin altitude is 37,000. He doesn't know why Joe keeps saying "Stewart" after repeated corrections. Hero is pretty dumb.

Center can't get our crew into Sewart because of heavy cross traffic at lower levels. They have been informed that our crew is running out of fuel. They ask Joe if the bird can get to "Hop." Hero and Joe search frantically for "Hop" or anything like it; they give up and say that they don't think they can make it to "Hop" and want to land at

Sewart. Come to find out when Center said "Hop" they meant Campbell AAF which has over 10,000 feet of concrete runway and is called, locally and colloquially, "Hop" because the servicing navaid is located at Hopkinsville and its call letters are HOP. Another rung over the side.

Center gives Joe a clearance to Sewart so complicated and so quickly that neither pilot can copy it much less comply with their limited fuel supply. It is dark by now and the red fuel low warning lights are casting a warm glow throughout the cockpit. Hero gives up the clearance routine and declares an emergency. A discrete GCA frequency is declined in favor of Guard channel. Hero is squawking "mayday" and GCA has him and is controlling the descent.

The indications from the VOR that Joe has cranked in don't look right to hero but Joe has complained about not being able to get the right identifier so hero ignores it, besides hero's middle initials are GCA. That ladder is just about fingertip high.

Hero's attitude indicator's red light goes out so he asks Joe to take the airplane since they are in night weather. Joe right away starts a climbing right turn. Hero now gets a clue that maybe Joe is on the sauce or something so he takes the airplane again and uses a very distracting white light to illuminate the instrument panel.

They break out of the clouds around 3000 feet in the very dark rain. Suddenly GCA isn't talking anymore. Hero and Joe call them frantically, individually and collectively. The tower responds very weakly with a steer to Sewart. This heading is almost the opposite from the VOR indication. Hero follows the steer; they have an oscillating indication of 30 gallons on the liquidometer and a flat zero on the totalizer.

"Semper Fi" is the first in a series of safety articles written by students attending the Flying Safety Officers' Course at the University of Southern California. Under the guidance of Col Daniel Lewis, USAF, Ret, formerly an information and Safety Education officer, and now a USC faculty member, articles such as this are being written as a school assignment. We of AEROSPACE SAFETY magazine staff are confident readers will find these articles refreshing, pertinent and of value to the accident prevention program.

"This is Goblin Control, can we be of assistance?" When hero hears this voice he looks up expecting to see something coming down like Mt. Sinai. Goblin control has been trying to tell Sewart GCA over the landline that they are making some serious errors in controlling hero but Sewart has ignored them because they were busy with an emergency, i.e. hero. Due to a radar phenomenon that hero still doesn't understand, Sewart was painting a reflection of his squawk and had run him 52 miles from the base.

When they are informed of their position our crew knows they'll never make Sewart with their fuel and ask for the nearest base. It's a small civilian field 15 miles distant; hero, with eyeballs on the plexiglass, spots a green light a long, long way off. He can't see a runway until Goblin asks them via landline to turn on their runway lights.

Now hero has been flying from a 12,500 foot runway that is 300 feet wide, has the IVALA system complete with strobe and centerline lights. The runway before him is 4800 feet long, 90 feet wide and has little approach lighting to speak of. He lands at least halfway down the runway; he knows there probably isn't a barrier and has no idea of the terrain. With supreme effort, hero goes around trying desperately not to look at the fuel indication.

Weather, FAA, GCA and Joe have all had a shot at pulling up hero's ladder and now it's his turn. Hero is going to have a short landing roll, he's going to slow it down and he's going to land on the end of the runway.

Hero doesn't know it but he's run out of rope, ladder that is. Over the end of the runway at a low airspeed he pulls off the power and, as advertised, the airplane quits flying and falls the remaining three or four feet and bounces into the air higher than hero knew anything could bounce. He applies power for recovery but due to an entire lack of fuel the engine does not respond. The next contact is nose first which blows a tire; the bird bounces again and the next contact again is nose first on the blown tire; the wheel cocks and the nose gear is ripped from the aircraft. Hero does indeed have a short landing roll.

Later, smoking several cigarettes and thinking about all the mountains they didn't run into, hero and Joe are approached by the first of a mob of natives. The local observes, "Say, you-all did a right smart job gittin' that there jet on this here field."

Hero, tired and tarnished, says, "Joe, get that man's name." ☆

CROSS COUNTRY NOTES

from REX RILEY

One of the best ways of identifying accident problem areas is to read safety publications of the other services and commands. Editors and safety officers use these publications as a means of alerting their people to current problems—and as a means of offering suggestions as to what to do about such problems.

Here's a f'rinstance, gleaned from half a dozen that accounted for an evening's homework for Rex:

Barrier engagements—not that barrier engagements themselves are particularly hazardous, rather that we still have drag chute failures, wheel and tire problems, takeoff abort situations, hydraulic failures—all sorts of things that can go wrong with the normal stopping systems of our birds.

Ejections. This is a real doozie. Four out of five jocks still make it—that's about the same average we've held for several years. And we've got more contraptions than the whole Rube Goldberg family could have devised. The sad part is, most all systems will work as designed . . . if they are maintained properly . . . if Dash One procedures are followed . . . if you jocks pull the handles before you get too low. Some mighty big "Ifs" there. Incidentally, a lot of people are working like mad to devise a true zero-zero ejection capability. It's needed for two reasons: once in a while a real hairy emergency crops up on the deck, and history shows that we need a system that will protect a few troops from their own mistakes.

Weather. This is one that really makes Rex shake his head. Month in and month out safety scribes pound away on this one. Here's one of those "known but unrespected" areas. Every winter a gaggle of fighters gets caught above a base that's socked in and they find out too late to run for an alternate. Sashayin' around in snowstorms, trying to get lined up with a couple of miles of concrete makes real scary reading. Rex doesn't envy these troops—usually a little better support and they wouldn't get trapped.

Design deficiencies. 'Wonder how many gear-ups we'd have had if the "Up" lever were located back in a cockpit corner almost out of reach and a long way from the flap handle? How many inadvertent drag chute jettisonings if the chute loosener were on the opposite side from the deployment handle? What would the rate be if all trainers would recover "hands off" from spins?

Discipline. Rex used to get as big a kick out of rat racing around the clouds as the next guy. But, like biplanes, free-to-do-with-as-you-please airspace is almost extinct. There's just too good a chance of coming eyeball to eyeball with some commercial joker. Uncle has some pretty sharp radar eyes now, so you'd better be where you're supposed to be at all times. Got to admit that this discipline thing makes sense, any way you slice it. A lot of Rex's friends aren't around to read this because they tried short cuts.

Complacency. There's another one that really gets a workout in the safety mags. Take an experienced pilot, gobs of hours in the bird, good weather, no mechanical problems, nice sunny day, maybe a sukoshe crosswind, and he bashes it. Throw in a little adversity and he hacks it every time (throw in a lot and he'll rack up a "Well Done").

Rex could go on and on like this, but you get the picture. The boys who put out these books keep eyes and ears peeled for accident trends and do their darndest to alert the troops. Their mags are monthly signboards, pointing out current pitfalls. Everyone who flys should read and apply the suggestions to his own situation. Next time you might just be the other guy—somebody always is!

ALL KINDS OF REASONS. With power plugged in, the T-33 pilot carried on with the starting procedures. Shortly, the landing gear decided to collapse. Fortunately the damage was minor or less. Unfortunately for him, the pilot was found at fault. The investigator felt the pilot failed to check the gear handle down and locked prior to engine start or he inadvertently raised the gear handle during start. A contributing cause factor was that the crew chief pulled the down lock safety pins prior to completion of engine start and without the go ahead from the pilot. The pilot was relieved of duties as an instructor pilot and will be given a goin' over stand check before flying again. You know what? No mention was made as to what, if any, actions were taken toward the crew chief. Strangely enough this happens too many times. We nail the pilots' hides to the wall but maintenance and supervisory troops get a slap on the wrist or a dressing down or verbal reprimand. Rex remembers a C-47 accident in which the control wheel chains on the pilot's side were re-installed backward. On takeoff the "Goon" banged real good and the crew almost bought the farm. Sure, the pilot got nailed good but the mechanic and inspector who were equally responsible got off scot-free. End of sermon that I promised I would avoid.

HELOS AND WHEEL FIRES

Capt Thomas C. Seebo
3560 PTWg, Webb AFB, Texas

An invaluable asset, as a bonus to bases with the Local Base Rescue (LBR) system, may be realized in the use of the HH-43B helicopter to cool brake or wheel fires.

Much has been written in AEROSPACE SAFETY (July 1961, March and July 1962) concerning the primary crash-rescue mission of this chopper with its fire fighting capability. Now, another effective use has been added to its flexibility. For example, Perrin AFB has used the HH-43B many times on wheel fires of the F-102. Some fire departments have found that portable fans placed beside hot brakes on large type aircraft are most effective. It stands to reason that the big fan provided by the HH-43B will do a more effective job.

Many personnel have been injured, some critically, from exploding wheels, locked brakes, or blown tires. There is a thin line between contained fire and disaster. When magnesium on wheels starts popping, it's obvious that a big knife of white flame is toying with that thin line. Another multimillion dollars worth of aerospace equipment could easily be scratched from the Air Force inventory. If a portable fan aids in containing a fire, why not use the cooling 30 to 40 knot wind generated by the HH-43B rotors?

Last year at Webb AFB there were numerous occurrences of hot wheels, locked brakes, and wheel fires on the T-38. Of major significance was a hot magnesium fire on one wheel. The fire department was having little success in combating the fire with established CB procedures. When the burning rubber of the tire was pulled with a grappling hook, magnesium sparks flew in all directions and firemen retreated to a safe distance. (Aircraft wheel explosions generally blow out perpendicular to the fuselage so the HH-43B is not endangered if hover is maintained with this factor in mind). The Fire Chief signaled the helicopter to a previously discussed hover position. The HH-43B was maintained in an up-wind hover position and within eight minutes, the crash crew could put their bare hands on the wheel. Subsequent to this experience, it has become standard practice to use the available LBR helicopter on hot brakes or wheel fires. Since ground firemen are able to stand away from the danger area, their exposure to the hazard of wheel fires has been minimized.

(A note of caution must be injected here for the crew of the helicopter: Fires of this type may take place in a row of parked aircraft. Therefore, extreme care must be exercised when maneuvering around this environment, which is usually avoided like the plague. Some associated hazards are: tails of large aircraft which extend many feet into the air, aircraft stands, vehicles, and loose objects, such as cowling, which may be blown about the ramp.)

One might theorize an FOD hazard from debris picked up by the rotor blast and forced into the engine of the distressed aircraft. Although we've not encountered it, this problem could be easily solved by intake plugs and exhaust covers installed by crash crews or an adequate inspection system.

More and more the airborne fire fighting rescue role is being adopted. The Civil Aeronautics Board recently published a study that mentioned the value of airborne crash rescue vehicles. Still there remain many skeptics concerning the value of the LBR-HH-43B in the role of fire fighting support or fire suppression. The most common misconception is the thought that the fresh air blown into the fire will cause the fire to burn more. On the contrary, the air cools the fire, metals, gases and fire fighters as well. The Air Force fire training school has compared the helicopter rotor wind action to that of blowing out the flame of a match.

Although this article deals primarily with a specialization in combating wheel fires, the role should not be restricted. This cooling effect should be employed to maximum advantage. Recall the B-47 disaster reported in November 1962 AEROSPACE SAFETY? Although the B-47 crew was rescued, four firemen were killed in an after-fire explosion. Here the cooling effect of the rotor wash possibly could have prevented the explosion. Thus, there is justification in not pulling the HH-43B away from its established fire fighting support position too soon.

Just where the missions of the LBR detachment and the Base Fire Department become separate is dependent upon personnel and situations. A sound training program, based upon mutual indoctrination, planning, and coordination by personnel of these two distinct and separate, yet complimentary, fire fighting units, will assure maximum mission safety and effectiveness whenever they work together. The HH-43B system has proven itself a valuable asset in fighting fires. The senior Fire Protection Supervisor on the scene should not hesitate to request an assist from the chopper's rotor wash if he deems it advisable.

What is gained by this use of this airborne rescue vehicle? First of all, there is the protection provided crash rescue teams. Second, the savings in aerospace equipment. Third, the increased capability provided base fire departments, particularly where explosive weapons are involved. Fourth is the relatively small danger to the HH-43B crew; and fifth is the added asset of giving the base and the Air Force more return for the individual dollar investment in the LBR detachment.

In short, a close coordination between Base Fire Departments and HH-43B LBR detachments can effectively result in saving of additional lives and equipment—a furtherance of the Air Rescue Service LBR mission, "That Others May Live." Coordinated training will lead to the professionalism and proficiency that makes any system function at peak capability. ☆

Fifteen Years Lip Service

Maj John V. Florio, AFRES, Alvin Callender Fld, New Orleans

In an age where air traffic has multiplied, speeds have trebled, aircraft have become infinitely more complicated and traffic procedures have become more complex and critical, I see statistics every day which prove that flying is safer than it ever was in the "good old days."

"But," I ask myself, "in the face of such evidence, why do we still have to read accident reports about the same old bonehead tricks that were pulled twenty years ago?"

One fellow blows a ship apart by taking off with a hot brake, another clobbers into the side of a mountain while trying to make up his own instrument approach in IFR weather, a third runs off the end of the runway by overloading his airplane or disregarding his computed takeoff data.

This last one can still be seen in many flight planning rooms any day in the week. This clown will spend the better part of an hour figuring performance figures to jot down on his checklist. He explains that this protects him in case "anything should happen." Then he taxis out, lines up with the runway and jams on full throttle, hoping that his crate flies before the runway runs out—just like in the "old days." No reference at all to the performance figures he has computed!

Why? It has been called poor judgment, poor technique, pilot error . . . put any label you want on it but what it really amounts to is that a small percentage of our people are only paying lip service to the flying safety program.

Here are some typical examples:

Take the aircraft commander who skips all or part of the walk-around inspection to make a takeoff time good, or the instructor pilot who tells his student that the lineup check is completed when it really isn't, but he's in a hurry to get back upstairs into the cool air, or the eager beaver who wouldn't hear of aborting a mission in spite of low torque readings at Decision Speed.

There are many examples I could go through, but you've come across these "vacations from good judgment" if you've but a few months' flying experience.

In the cockpit, there is always the pressure of time. Quick decisions are a must. But most decisions are made for us in the Dash One or the appropriate standardization manual. All that is necessary is that we know our "bible." To my mind this is the big difference between the non-professional and the real aircraft commander.

We have another hazard at the supervisory level. In recent years, because of the increased reliance on stereotyped instruction, grading and evaluation, and because of the increased dollar consciousness, we are developing some of the following types:

- The operations type who sends off a 27-ship formation in marginal weather because he "just has to fill in those squares on the training chart before an inspection."
- The operations officer who reprimands one of his aircraft commanders or instructor pilots for not flying through a severe weather area to get his airplane back on time. Almost every issue of every safety magazine printed has one or more articles on the foolishness of blasting through a squall line or even small thunderstorms, but this makes no impression on the "boss man."
- The commanding officer who unofficially criticizes the instructor pilot who sat down at an outlying field when it became necessary to cage one while over the field. The commander argues that the home field was only 30 minutes away and,

after all, "the bird could fly all day on one engine. Look at all the expense and overtime that could have been saved." I wonder how sympathetic he would be if the IP tried to make it back and creamed the aircraft? Mission accomplishment is a fine thing but it should not be allowed to color the pilot's judgment. Nor should pressure be applied to sway his decision. No matter how realistic an exercise is, it is still a peacetime operation. In fact, even in time of war, I wonder whether it would be better to abort the mission and have the airplane and crew available for another day, or to send them out and lose them! There are many more examples that could be quoted—and I can't entirely blame the supervisory types I've described. They can't do anything about the pressures from above!

In spite of the examples described, I've never come away from a mission briefing without hearing the mission commander say, with great dignity, "flying safety will not be compromised under any circumstance."

If that isn't lip service then I don't know what is!

"So what's the answer?" you ask.

The answer lies with every one of us who wears the shield on his wings. Remembering always that there is no peacetime mission that can justify the loss of a ship or crew, because of cutting corners or bending regulations. We can base our decisions on what we know to be sound judgment.

Learn to overcome "get-home-itis" and "I can always go 100 lower than minimums." Recognize the fact that you, the pilot, are the ultimate deciding factor in the conduct of the flight. Use your prerogatives. Only you know your own limitations. Only you will answer to the Chief Pilot "up there" for the lives you take with you through irresponsible decision making.

Do these things and maybe in another quarter century you will be writing articles, advising young tigers in matters aeronautical!

I'll be reading them on an RON on some far off asteroid in another galaxy (an expression I got from my son).

How do I know I'll still be around?

I know because I fly by the book —do you? ☆

TAX's

ACCIDENTS, INCIDENTS AND ALMOST . . .

▶ **FOR LACK OF A BRIEFING.** Primary cause for this major accident was levied on the pilot for the straightforward reason that he landed at an incorrect and unsuitable airfield. But consider how improbable this accident would have been had not the following discrepancies also existed:

The crew had not been given a route check into the area.

Neither the crew nor the mission commander had been properly briefed on the mission.

The mission commander failed to closely review pre-planned crew scheduling and route check accomplishment.

Adequate aircrew folders had not been provided for the aircrews.

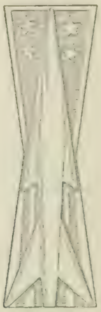
▶ **FUEL FUMES IN KC-97s.** Fuel fumes were noted in the cockpit shortly after the KC-97 had taken off. The mission was aborted and the aircraft landed without incident. A check of the aerial refueling system disclosed cracks in the drain tube assemblies. Most probable cause was freezing of moisture which had collected in the lines, causing expansion and subsequent cracking of the fuel lines.

▶ **BIRDS' RUNWAY.** Shortly after unstick and prior to gear retraction, a KC-135 flew through a flock of young seagulls, killing an estimated 40 birds. One or more were ingested into the Nr 2 engine, causing momentary torching, but no loss of power. All copilot's and navigator's airspeed indications were noted to be fluctuating and reading incorrectly. Fuel was dumped and the aircraft returned for landing. Nr 2 engine was changed due to severe bending of inlet guide vanes. The right pitot mast was bent and dented and numerous small dents were found on the leading edge of the wing.

Local procedures now include a physical check of the runway each day after sunrise and prior to the first takeoff.

▶ **SLOW SUPERSABRE.** At 4500 feet, 350 knots, on a night training mission the F-100 experienced what the pilot interpreted to be a power loss. But a check of engine instruments showed everything to be normal. Just to be on the safe side, he decided to land at a nearby AF base. Upon landing he discovered that his drag chute had deployed during flight. The drag chute canopy was fully blossomed and none of the risers had failed, nor did the chute show any signs of being burned. The coupling, which the books say will shear at airspeeds above 180 knots, still held at 350 knots.

▶ **SIDEWAYS FLIGHT.** At 5000 feet, when speed brakes were opened, the F-106 pilot heard a loud noise, the nose veered right and the airplane slid left. Speed brakes were closed immediately. Flight was normal. Another F-106 was contacted and came alongside. Again the speed brakes were opened. Chase noticed that the right brake came open, but the left remained closed. Hydraulic fluid was noted to be coming from the speed brake area. Speed brakes were closed. A seven and one-half inch crack running the length of the extended part of the actuator was found after landing. ☆



MISSILANEA

CRITICAL PERSONNEL PERFORMANCE—It seems that every organization has its share of "devil-may-care" characters. They chance injury and even death at every turn and go on laughing. That is, until they get caught in a squeeze.

Take the example of the airman who was to be suited in protective clothing for a hazardous area task. Contrary to all tech data and standard operating procedures, less than the required number of people were used to do the job of suiting the man. No check-out of the air supply valves was made, no communications system check-out was accomplished and, after suiting, the supporting personnel failed to remain in the standby area to assist the man in the suit in case of an emergency. Results: The airman in the suit had no communications capability; he experienced difficulty in breathing and left the hazard area in the wrong direction. He failed to pop his face mask or unzip the suit and was found in the shower room in a dangerous state of exhaustion.

What does this point out? HUMAN ERROR.

How does one cope with this? TRAINING.

Management must maintain adequate supervision, assure that personnel are properly trained, and emphasize the importance of abiding by published directives.

Lt Col J. F. Smejkal, Directorate of Aerospace Safety

TORN TAIL—It was 0845 on a rainy morning. The sky was overcast and the wind was blowing at 18 knots, gusting to 27. Visibility was reduced. The temperature was 53° F. It was not exactly picnic weather and certainly not the type of weather conducive to safe operations.

Due to launch site construction, spare Mace missiles were being stored temporarily in earth-covered aircraft shelters which can accommodate six missiles. These shelters have sloping walls with large, exposed brace beams. One of the three missiles already parked was 12 inches off position, thus restricting the parking of additional missiles. Spotters were properly positioned, but while the fourth missile was being backed into the unlighted shelter, the horizontal stabilizer assembly was forced against a brace beam of the shelter, causing a 15-inch tear, six inches from the tip. As the tear exceeded the criteria for repair, the damaged component had to be replaced.

Primary cause was supervisory error in that the crew chief failed to stop the operation when adverse weather warranted it. Contributing cause factors were: (1) Previously parked missile not properly aligned. (2) MM-1 truck is difficult to maneuver in close quarters because of the high RPM required for adequate power steering and resultant lurching of the vehicle. (3) Lack of intercom between crew chief, spotters, and MM-1 operator. The high RPM of the MM-1 trucks creates about 100 decibels of noise which makes voice communication almost impossible. (4) Lack of painted guide lines to indicate correct position for parked vehicles. (5) Prevailing weather which caused the interior of unlighted shelter to be very dark.

Action taken or contemplated: (1) Guide lines will be painted. (2) Maintenance supervisors and crew chiefs have been cautioned against attempting operations during adverse weather conditions. (3) A study will be submitted to WRAMA recommending replacement of some MM-1 vehicles with modified M-series semi-tractors for maneuvering in close quarters. (4) The installed translauncher intercom system is being studied for possible use between spotter, crew chief, and operator positions. (5) The number of missiles stored in each shelter will be limited to four.

This mishap points up the need for continuous vigilance of activities that deviate temporarily from the normal pattern of operations. Supervisors and crew chiefs should analyze each new operation to be performed and insure that any threat to safety is eliminated or minimized.

Where high noise levels restrict voice communication, the use of standard hand signals is recommended. However, if you can't see or hear each other, common sense dictates that the operation should be delayed pending arrival of a more favorable environment.

Lt Col John A. Worhach, Directorate of Aerospace Safety

SECURITY LIGHT RESET—LCC. During a recent test exercise it was noted that the Outer Security Violated and the Inner Security Violated warning lights on the Missile Status Indicator Panel of the Launch Control Console could be reset by depressing the display selector pushbutton only. This appears to be at variance with the technical manual which implies that both the Security Reset button on the Alarm Monitor Panel and the display selector pushbutton must be depressed to extinguish these lights.

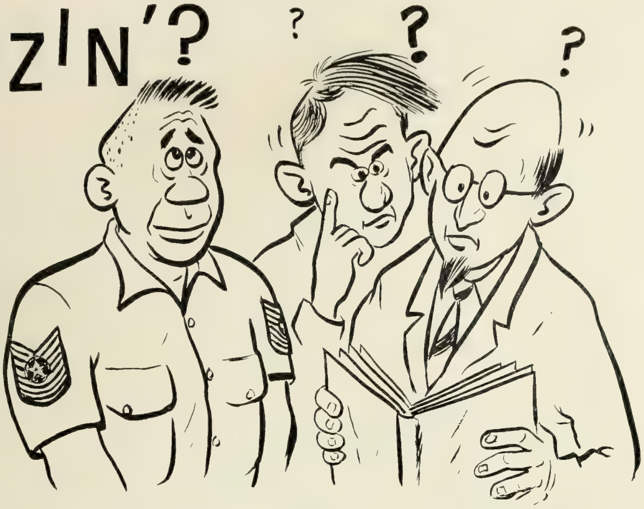
An examination of the circuit reveals that the lamp-driver circuit is so designed that a loss of SCN common, which occurs when the display selector pushbutton is actuated, can allow a clock pulse to reset the lamp-driver flip-flop, thus extinguishing the Inner and Outer Security Alarm indicators.

Use of the display selector pushbutton alone for reset is not detrimental to the equipment. The important thing is for users of the system to recognize that reset on the single button is normal and is not an indication of a malfunction. A technical manual change to reflect this has been recommended.

Minuteman Service News, Boeing Aero-Space Div

Lt Col John L. Anderson, Directorate of Aerospace Safety

CONFOOZIN'?



We're always pounding you troops on the head to use tech orders. So, the other day when we were confronted with a pretty important problem, we quite naturally went to the tech order to look up the answer. (Good idea to practice what we preach, you know.) No sweat, we figgered. All we gotta do is turn to the proper section and read the answer. Oh, it might take a little thought and some interpretation, but the essentials are all there. Whoa! Wait a minute—better make sure we've got the right section—wouldn't want to quote the wrong section or checklist, or otherwise we might destroy the image that we safety troops have struggled to build as "experts" in all matters. Here's how the sentence on applicability reads:

> "This section is used to verify the warning and alarm system readiness only in event of a malfunction of a related system during launch control system to standby . . ."

Now, that sentence may be pretty straightforward to you, but it didn't make much sense to us. We thought we had the thread of it for a minute, until we began to flounder on the part about a "related system." (Aren't all systems related? Maybe they're talking about another weapons system!) By the time we got to the part about ". . . during launch control system to standby . . ." we found ourselves going under for the third time.

Well, we thought, this is a fine kettle of fish! First time in months we've been stumped by a tech order, but by George, we're having trouble reading this one! Must be out of practice, eh? Hopelessly confused as to whether or not we should use this section, we decided to consult some of our college-trained engineering friends and ask them to explain its meaning. Noting the puzzled looks on their faces, it wasn't too long until we became convinced that they weren't any smarter than we when it came to reading. A little head-scratching on the part of several others soon made it pretty clear that the problem was not really the intelligence level of the reader. The sentence was just extremely difficult to understand.

Now, we don't want to keep kicking a dead horse and we certainly don't intend to make a federal case out of this particular sentence. If it makes sense to you—fine! Please explain it to your buddies. But, it didn't make sense to us and we're still not sure as to when we're supposed to use this section. Our only reason for bringing the matter up is to serve as an example that not all of the people who use tech orders fully understand all of the words. (We have a sneaking suspicion that not all of them are in our shop!) Even if the reader understands the words, the sentence may be meaningless and confusing to him because of the way the words are put together.

So, what's all the fuss about one little sentence in one small section taken from reams and reams of tech data? And, furthermore, what does all this have to do with safety? Simply this—if we must use tech orders to operate and maintain Air Force equipment (and we must!)—let's be absolutely certain that all the troops understand precisely what, when, and how they are supposed to do a given task. If they don't understand what to do and when and how to do it, and in the process they happen to fracture the bird, that would be an accident; but, when the old man finds out that the accident could have been prevented, he may in turn fracture the responsible supervisor's career—and that wouldn't be an accident!

If you really want to save the birds (and perhaps a career or two—one of which may be your own), you might find it lucrative to deliberately browse through the tech orders on your "related systems" to make sure they are readily and easily understood. If they don't make sense to you, the chances are real good that they won't make sense to someone else. Once you're convinced that the fog count is much too high for clarity and complete understanding, then make out an AFTO Form 22 and send it in.

Now, if you'll excuse us, we've gotta fill out a form. Let's see now—how do you spell confoozin'? ☆

Aerobits

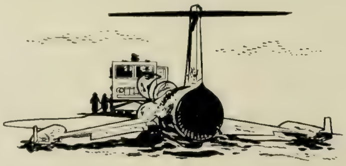
BACKSTOP PAYOFF—Here's a case where a backup barrier system really paid off. At 175 knots, after nosewheel liftoff and as the F-100 was becoming airborne, the windshield fogged over.

Abort!

Drag chute was deployed, then the tail hook released. The hook first touched the runway 336 feet short of the BAK 9 cable. Due to the fact that the pilot was riding the exact centerline of the runway, and there were irregularities in the surface of the thermo-plastic centerline paint, the hook bounced just before reaching the cable. The hook struck the cable slightly above cable centerline, one inch left of a rubber donut, and failed to catch. Pilot confidence in cable engagement led to a delayed decision to jettison external stores until too late.

The aircraft successfully engaged the MA-1A barrier with the gear at approximately 100 knots. The tail hook also engaged the MA-1A adapter cable, but the entire restraining force was borne by the primary cable around the main gear. Engagement was 20 feet off center with only slight swerve encountered with chain pickup. Runout extended 1150 feet past the end of the runway and both chains were pulled their entire length. Damage was limited to a small fairing panel and wiring on the nosewheel strut plus badly worn tires.

Suggestions: Don't abort at such a critical point when adequate viz can be maintained through the canopy, when instrument flight can be made or when control can be passed to an IP. Properly purge vent system and preheat canopy and windscreens. Don't drag hooks on centerline stripes. Paint runways with smooth paint.



AN F-104 MIRACLE

Two F-104B pilots were engaged in flameout landing practice. After a low approach the gear failed to retract. At this time the pilots chose to leave the gear handle down with the gear indicating down and locked, and commence practicing standard SFO patterns, using AB to get back to the appropriate SFO altitude. The next pattern appeared good at the low key. At the 270-degree point the front seat pilot felt he was too far out and decided to turn short, angling in toward the runway. Both pilots still felt the positioning was satisfactory. At approximately 500 feet above the ground the front seat pilot decided sink rate was excessive and advanced throttle to full military power. Both pilots noted 230K right after power advance.

With sink rate still excessive, the pilot anticipated hitting short and rolled the wings level. About 10 or 15 seconds after the power change, the right tip tank and main gear struck the ground almost 500 feet from the end of the runway. The right main gear failed upon impact. The left main and nose gear then collapsed and the aircraft skidded almost 2600 feet before stopping.

Immediately after initial contact with the runway the pilot in the back seat intentionally ejected himself. The floor of both cockpits rapidly disintegrated during the skid and caused initiators in the front seat ejection system to fire, pulling the pilot's feet into the seat stirrups and ejecting his canopy. The seat itself did not fire due to the binding of the right leg guard on the right lower console, thus preventing rotation of the torque tube.

As the aircraft slid to a stop, fire broke out below the rear cockpit and in the left wheel well.

The pilot in the front seat stopcocked the throttle and tried to get out of the aircraft. Before he could do so it was necessary to pull the cable cutter lanyard over his right shoulder. This done, he departed the aircraft without further difficulty, noting for the first time that the rear cockpit was empty.

The pilot in the back seat landed safely 1591 feet from the initial contact point and ran to join the other pilot.

Neither pilot received injuries other than minor abrasions in spite of the fact that the pilot in the back did not have his zero lanyard hooked.

This accident emphasizes again that there is no room for the pilot to err, particularly in an exacting maneuver such as a flameout landing. Probably one outcome of this accident will be a Dash One revision making the A model flameout airspeeds compatible with those of the C model to provide a better margin of safety.

It is not our position or desire, to place blame or ascertain who was at fault, but rather to present enough factual information to enable the reader to realize the seriousness of emergencies of this nature. However, it appears appropriate to recall that, over the years, it has frequently been not the failure of a single component, but the desire to continue the mission in the face of a component or system failure that has led to trouble.

In peacetime operation it makes sense to put the bird on the ground, get it fixed, then continue the mission.

Lt Col Frederick C. Blessé, Directorate of Aerospace Safety

DISASTROUS DESCENTS. Look back several years in the accident history of the F-102 and you will discover many problems associated with the operation of the aircraft. Many of these problems have been resolved; others appear on an intermittent basis and some problems continually occur with almost certain predictability.

Among the latter, one of the perennial problems involves aircraft descending below the glide path on final approach. A significant factor of these losses is the consistent frequency of occurrence.

September 1957: During final approach the F-102 struck a telephone pole 1870 feet short of the runway . . .

August 1958: During a GCA the F-102 descended below the glide path and contacted the tops of trees . . .

June 1959: During a GCA the F-102 descended below the glide path and contacted the ground 75 feet short of the runway . . .

May 1960: During a GCA the F-102 descended below the glide path and contacted the ground 300 feet short of the runway . . .

February 1961: During a GCA the F-102 descended below the glide path and contacted a fence 450 feet short of the runway . . .

December 1962: During a GCA the F-102 descended below the glide path and contacted the tops of trees one and three-fourths miles short of runway . . .

April 1963: During a GCA the aircraft descended below the desired glide path and contacted the approach lights . . .

Pilot experience in these mishaps ranged from a low of 500 hours to over 2000 flying hours. All pilots had full power available, all flight instruments were operating properly, and there were no flight control malfunctions. Amazingly, none of the pilots was injured.

Although some of the mishaps involved supervision, weather, and other factors, it was the pilot, in all instances, who permitted the aircraft to deviate from the glide path.

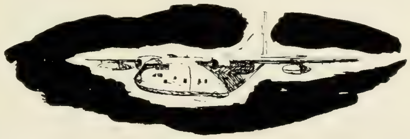
Inexperience, anxiety, and complacency are overworked terms in an attempt to account for mishaps of this sort; for the possible consequence of permitting an aircraft to descend below the glide path is as obvious to the fledgling as it is to the eagle. Yet if history repeats itself, we can anticipate a similar F-102 accident during 1964.

To rebrief pilots advising them not to fly below the glide path, is hardly the answer. It has not worked in the past; it insults the intelligence of a professional pilot.

There is no simple solution to this problem. No one magic action or monumental directive will eliminate this type accident. The course of action rests with each pilot; for the repetitive history of these mishaps leads to an almost certain prediction that at least one pilot, during 1964, will fly an F-102 below the glide path and have an accident.

The intent of presenting this information is to remind you, as a pilot, of this perennial problem. Perhaps the knowledge gained by an awareness of past experience will place this problem in a perspective which is close to home. If it does, we may succeed in eliminating this type mishap during 1964.

Capt Vernon G. Knourek
Directorate of Aerospace Safety



DOUBLE TROUBLE—At 9000 assigned, in a congested area on the east coast, pilots of a C-123 spotted a jet transport on a climbing, left turn collision course. They turned left and pulled up and noted the conflicting aircraft to level momentarily and pass 500 feet below and 1000 feet in front. As the pilots of the C-123 had been advised their aircraft was on Center's radar, they queried as to the reason for the near collision. Center reported that the jet had taken off from a nearby field and the pilot claimed not to have been above 8000 at the time of the incident. Within thirty minutes, and after Center had called a target, the C-123 pilots again took evasive action to avoid another transport that appeared to be on a collision course.

C-123 INFLIGHT FIRE. Runup and takeoff of the C-123 were normal. After takeoff the nose gear failed to indicate up and locked. As the pilot recycled the gear the tower advised that the Nr 1 engine appeared to be on fire. There were no indications of fire from the engine fire warning system at this time. A visual check by the flight engineer confirmed the tower report. At this time the fire warning system T handle did light up. The engine fire inflight procedure was carried out and the aircraft circled to land. The fire was seen to die down, but smoke continued from the accessory section. Upon landing the fire flared up again and had to be extinguished by the crash crew. The fire resulted when hydraulic fluid was sprayed in the engine accessory section from a rupture of the hydraulic pressure hose on the outlet side of the engine driven hydraulic pump.

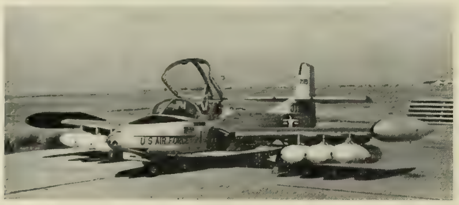
Aerobits

T-29 CONTROL SURFACE LOCK. During takeoff roll, after directional control was transferred from nosewheel steering to rudder, a minor correction was attempted; however, the rudder was locked. The takeoff was aborted and during the last part of the rollout the rudder reacted normally. A high speed taxi check was accomplished and all control movements checked from the cockpit. The aircraft then took off and the flight was normal. After the flight, the controls were locked and unlocked several times. The rudder would stay locked intermittently in the unlocked position.

Investigation revealed the locking pin to be broken at the first gear serration, and the top of the pin was lying on the floor of the fuselage.

This malfunction could have resulted in the loss of the aircraft and crew. Any binding or unintentional locking of controls should be thoroughly investigated by qualified maintenance personnel prior to further flight.

Lt Col James F. Fowler,
Directorate of Aerospace Safety

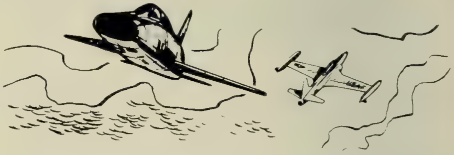


THE YAT-37D. Two twin-jet YAT-37Ds, combat version of the T-37 primary trainer, have been turned over to the Air Force by Cessna Aircraft Company. One of the aircraft is at Edwards Air Force Base where it is undergoing a 22-week flight evaluation by test pilots at the Air Force Flight Test Center. The YAT-37D has General Electric J85/J2 engines that produce twice the power of the trainer version. The aircraft is designed to operate out of short, unimproved strips and can carry up to 3000 lbs of armament. Special features include wing tiptanks, under-wing 100-gallon drop tanks, cockpit armor and an electronics package for communication, navigation and target acquisition.

OBSTACLES—Perhaps pilots don't need a reminder that "when you're on the deck you'd better check." But now and then something reaches up and grabs some luckless soul, hence the following:

The pilot of an F-104C was on a low level mission about 500 feet above the ground at around 425 kts. When he saw a high tension line tower ahead on the left he added power and began a pull-up. He didn't quite make it. The cables shattered the windscreen and did other assorted damage. The pilot's mask was torn loose and he received facial injuries but he kept his head and called for help. Another pilot joined him and led him in for a successful landing. Damage consisted of a bent refueling boom, windscreen and side panels shattered and their metal supports bent, canopy glass broken and other damage to the canopy, damaged nose gear doors, small part of left leading edge flap broken out, hole in the top of the left drop tank.

There's a joker on those power lines that may not be common knowledge. The big lines you see sagging down between towers carry the juice—usually 220 KV. Up above them, taut, smaller, and harder to see, is a ground line known as the skyline. Possibly this pilot failed to see the skyline and drove into it while avoiding the bigger power lines. Remember that little joker on top!



RANGE ESTIMATES—Several Air Force pilots on duty with the Federal Aviation Agency's National Aviation Facilities Experimental Center (NAFEC) at Atlantic City, N. J., took part in recent flight safety research studies being carried out for the FAA by the Applied Psychology Corporation. One of the series of studies investigated the role of pilots' range and altitude judgment in midair collision prevention. Conclusions, based on laboratory experiments, F-100 flight simulator studies, and a program of flight tests, were that:

- Pilots tend to overestimate the ranges of aircraft relatively close to them, and to underestimate the ranges of those farther away. (Misjudgment of the range of a nearby threat can engender complacency.)
- Pilots are generally imprecise in their judgments of altitude, and somewhat better in judging relative altitude in gross categories. (Unaided altitude estimates were poor but pilots could accurately judge whether other aircraft were above, level with, or below them.)
- A considerable improvement in pilots' ability to estimate the range of observed aircraft can be realized through training. (Pilots received both air-to-air and ground-to-air training by the "immediate knowledge of results" method of training.)
- Pilots should gain range estimating experience by estimating and verifying ranges as a personal aid in evaluating collision threats. (Individual accuracy differences are large. The most experienced flyer was the most accurate in daylight, but not at night. Do-it-yourself training can consist of your comparing your estimate of the range of visible traffic with that reported by radar advisory.) ☆

Col Leslie O. Peterson (Ret.)
Applied Psychology Corp.

WELL DONE

TSgt. Elmer F. Schilling

433 TROOP CARRIER WING, AFRES, KELLY AFB, TEXAS

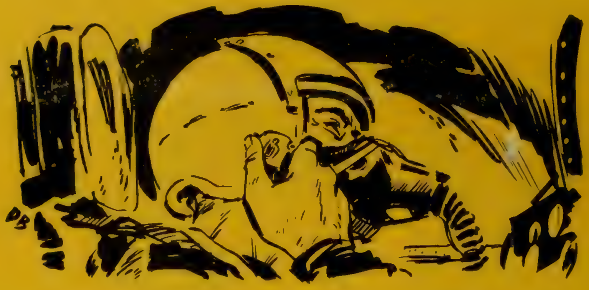
Technical Sergeant Elmer F. Schilling, a loadmaster in the 433 Troop Carrier Wing, AFRES, Kelly AFB, Texas, distinguished himself through personal bravery in aerial flight and extraordinary achievement under extremely hazardous conditions on two occasions within a 35 day period.

The first incident occurred on 5 August 1963 during Exercise Swift Strike III. Following loss of an engine, six minutes from the drop zone, the C-119 was unable to maintain altitude and it was necessary to salvo the heavy equipment load. With complete disregard for his own safety and at great personal risk, Sergeant Schilling worked in the open cargo compartment of the aircraft, removed all restraints on the heavy equipment and armed the load for jettison. This was accomplished in an extremely short period of time. He then stored all loose equipment in the cargo area until ordered to return to the cockpit because of the impending crash. After the crash landing, he assisted in freeing the other crewmembers from the wreckage, in spite of a badly dislocated shoulder.

Sergeant Schilling returned to flying status on 6 September 1963. Three days later, on 9 September 1963, when he was participating as loadmaster on the heavy drop mission in the Troop Carrier Competition at Clinton County AFB, Ohio, the C-119 developed an engine malfunction on takeoff and the pilot attempted to return to the base. An emergency was declared and Sgt Schilling was told to prepare the 3490 pound load for jettison. Again, at great personal risk and complete disregard for his own safety, he left his seat and worked in the open cargo compartment of the aircraft, releasing all tie-down shackles and armed the extraction parachute on the heavy load. This was accomplished in less than one minute, under extremely hazardous conditions with the aircraft steadily losing altitude and flying at less than 600 feet. He notified the pilot that the load could be salvoed, secured all loose equipment, and returned to his seat after giving the two passengers additional instructions as to what to do in event of crash landing. About 60 seconds later the load was jettisoned successfully and the aircraft crash landed. After the crash landing, he assisted the passengers from the aircraft.

In each of the above instances, had it not been for Sergeant Schilling's thorough job knowledge, quick action, and cool thinking under duress, severe injury or loss of lives would have resulted. This airman's reactions during inflight emergency situations are exemplary and reflect great credit upon the Air Force, the Air Force Reserve, and his unit of assignment. ☆

My thoughts



FOR A SAFE FLIGHT

1. I am physically, mentally and aeronautically prepared for the flight involved, a flight which I know will be in keeping with safe and approved operating procedures.

2. I know the safe operating techniques of my aircraft, and I shall make every effort to assure that my aircraft is in a good state of airworthiness.

3. I know my own limitations.

4. I will maintain the highest degree of vigilance throughout the conduct of my flight, being always mindful of the risk to human lives and property while I am at the controls.

5. I know the performance capabilities and limitations of my aircraft and have studied and reviewed all applicable emergency procedures to the extent that I can perform them under the pressure of any emergency.

6. I have a thorough understanding of existing weather conditions in my area of operation, and I have given considerable thought to alternative actions should there be an unexpected change in the weather conditions while I am airborne.

7. I will stay "ahead of my aircraft" and be in control of every phase of the flight.

8. I will make a precautionary landing as soon as possible, when any condition or occurrence causes me to deem it inadvisable to continue my flight. Unfavorable weather conditions, unfavorable wind conditions, a fuel state lower than that consistent with safe flight planning, a condition or discrepancy in my aircraft or powerplant that I do not understand, shall be predetermined conditions for discontinuing the flight.

9. I will always keep in mind that the flight does not end until the aircraft has been brought to a stop and the engine(s) shut down.

10. I will make appropriate notes and discuss with appropriate persons any mistakes or errors in judgment pertaining to my flight even though they may have been unobserved by others. This action may benefit other pilots or disclose an area for improvement in my piloting ability.

CIVIL AERONAUTICS BOARD BUREAU OF SAFETY

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AEROSPACE
SAFETY

UNITED STATES AIR FORCE

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MISSILE SAFETY REPORT

In all commands, 1963 was a year of solid progress toward professional missile safety programs. A survey of 1963 mishap data, although it shows a numerical increase over the preceding year, indicates impressive total results, especially in ballistic missile systems. This increase of 36 mishaps over 1962, while moderate, would appear to be a backward step until the following factors are considered.

Although the number of tactical missiles remained relatively stable in 1963, there was a 70 per cent increase in the ballistic missile inventory. In addition, increased expenditures of airborne AGM-12B (Bullpup) missiles in "Operation Full Scope" and TAC Project 63-71 were responsible for an increase in Bullpup mishaps over 1962. Despite the major growth in the ballistic missile inventory, there was an over-all decline of 5 per cent in ballistic missile mishaps.

In 1962 there were 24 missile accidents. In 1963, there were 10. These gains reflect command support and substantial progress by field missile safety officers in implementing effective missile safety programs.

Current studies in progress as a result of the Fourth Annual USAF Safety Congress highlight certain significant factors not commonly known. Excluding the abnormal surge of Bullpup air-launched mishaps, materiel failure accounted for approximately 39 per cent and design deficiencies for slightly more than 7 per cent of the 1963 mishaps. Personnel error ran a close second with 38 per cent, miscellaneous and unknown causes accounted for slightly more than 6 per cent, weather causes ran a little above 3 per cent, and an old contributor, technical data deficiencies, is on the wane and accounted for less than 1 per cent of the 1963 mishap picture.

As reported from the field, supervisory error was a primary cause factor in less than 5 per cent of all mishaps. It is the considered opinion of many unbiased safety experts that, wherever personnel error has been a factor in a mishap, supervisory error may be partially or, in some cases, wholly responsible. This low reporting rate of supervisory error may be attributed to a natural reluctance toward self-evaluation, or to incomplete mishap investigations. A more realistic commander's appraisal of causes may be the key to a significant reduction of personnel error mishaps by means of more thorough supervision.

In the area of personnel error, the 1964 Missile Safety Program, presented at the Fourth Congress, advocated shredout of personnel error into the following categories for special study: (1) operator error, (2) maintenance error, (3) ground-handling error. Supervisory error was recommended as a separate category.

It is now believed that this shredout may not be complete enough for thorough evaluation, especially in the maintenance area. It is also thought that supervisory error can be more precisely identified through shredout of a broad, over-all human error category. The results of a current study, with recommendations for category changes, will be presented at the Fifth Congress.

Although materiel failure is a major contributor in all systems, this factor varies widely by weapon system. A departure from the norm appears in the AGM-12B airborne missile system. This is the result of major exercises, only, and is not a cause for alarm. Reliability data for the Bullpup indicated performance in excess of specification. Since each launch results in destruction of the missile, it is difficult to identify other causes that may be present in addition to materiel failures.

All in all, the progress made in 1963 is substantial and gratifying. It is indicative of continued missile safety progress. ☆

Colonel George T. Buck
Chief, Missile Safety Division

FALLOUT

OUR STORY

I wish to take this opportunity to commend you on your excellent article titled "Our Story" (September 1963). One cannot help but admire the resolution of the Transient Alert Personnel who so often bear the brunt of undue criticism, yet manage to "keep smiling."

As one of the fortunate few RCAF pilots who frequents USAF bases throughout the USA, I can personally testify to the courteous efficiency (even under the severest of conditions) that is prevalent amongst "T/A" personnel.

H. F. Kelly, Flt Lieut, RCAF
RCAF Sta. North Bay, Ont.

JUNK IN JP-4

The December 1963 issue of AEROSPACE SAFETY contains an excellent article, "Junk in the JP-4," which is of great interest to us in the Joint Area Petroleum Office. The problems presented are those we all face continuously in handling the large quantities of fuel used in this area. We would like to get about 20 extra copies of this article to insure that all our customers throughout the Med Area are acquainted with it. The more information they have on this subject, the more apt we are to have completely satisfactory fuel-handling procedures. This applies to NATO users as well as our own people. Thank you for your assistance.

Lt Col Keith Sherman, USA
USNFE, Joint Area Petroleum
Office, FPO New York, N.Y.

Copies forwarded, glad we can help.

SNAKE PIT

The article titled "The Snake Pit" in the December issue moves me to ponder what the pilot was doing about the snake's friends . . . the pink elephant who was trying to stomp on his toes and the little green men who were attempting to unscrew his nose!

All of the above purely in jest, sir—but I still wonder just how much convincing it took to get that pilot back into "The Snake Pit."

May I take this opportunity of extending the congratulations of 414 "Black Knight" Squadron to you and your staff on an excellent magazine.

Douglas G. Bremner, F/O, RCAF
414 All Weather Fighter Sq
North Bay, Ontario, Canada

AEROSPACE
SAFETY

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VOLUME TWENTY NUMBER FOUR — USAF Recurring Publication 62-1

BOOMER TWO, ARE YOU THERE?

"Boomer two, did you copy the clearance?"

"Rog."

"Let's go channel three for taxi."

I acknowledged the channel change by calling my position in formation. "Two." It was quick, a reflection of confidence; another enjoyable flight about to get under way.

We were a flight of two T-38s departing on an IFR formation leg of a student cross-country. Heat was giving way to a cool, on-shore breeze. Weather was 800 feet scattered, 1500 feet overcast, seven miles. In our normal formation briefing we had covered weather procedures in detail, anticipating at least a portion of the climb through clouds.

My student had been having some trouble with radio procedures so I controlled radios in the back seat for departure. Our IFR clearance had come through as requested; direct to our first navigation fix, via flight plan route, maintain flight level 330. Approaching the active runway, ground control instructed us to change to tower frequency for takeoff. After we checked in on the new frequency, tower gave us the winds and cleared us for takeoff. At Lead's request tower confirmed clearance for a left turn out of traffic, climb on course. This was the first mention of any departure procedure although it was what we had requested on the Form 175.

Shortly after the flaps came up on takeoff, tower called again and cleared us to contact departure control on frequency 285.6. Lead acknowledged but didn't call the frequency change until we had passed our critical altitude of 1000 feet. As he called the change, we were in our left turn and approaching the overcast layer. My student had been doing a good job but when he began to take excessive spacing in the turn I took control of the aircraft. Now to make that frequency change. I quickly spun in 286.5 and checked in.

Silence.

I realized I was on the wrong frequency. Did the student hear and remember the frequency? No. Well, no sweat, I remember the departure booklet on my knee pad reflected the proper frequency. Fooled again.

Capt A. R. Langford, 3500 PTW, Reese AFB, Texas

I had knocked it off of my knee pad and it was out of reach behind the rudder pedal. Enough of this spasing around while trying to hold a wing position. I switched to our pre-briefed formation frequency (a pre-set channel), relaxed a little and maintained position.

I had confidence in the instructor in the lead aircraft and could see him bend to make several frequency changes in the climbout. I knew that when he finally got a frequency we would be on for a while, he would call me on our formation channel and give me the frequency. Shortly after level off, I heard his call.

"Boomer two, are you there?"

"Rog."

"Let's go 291.4."

"Two."

Men, this problem of radio frequency changes needs improvement! And particularly on IFR departures. Here's today's sequence on a typical IFR departure to high altitude. A flight clearance on one frequency, change for taxiing, obtain takeoff clearance on another frequency and still another change for departure control. Then the change to the intermediate altitude ARTC center controller and another change to the sector controller above flight level 240. By that time you're probably departing his sector and have to make one more frequency change before you can sit back and relax a little. This means six or seven frequency changes in a period of ten minutes or less for high performance aircraft.

You multi-engine jocks may say, "No sweat, my copilot or radio operator can handle it all and still have time to pour coffee." But it is a real difficult problem for a guy by himself, or worse yet, a guy by himself flying wing position. I even suspect that you guys who drive the heavies are occasionally a little irked by it all.

What can we do about it?

Be aware of the problem and use as much pre-planning as possible. This will help ward off confusion and distractions that may occur once we get the bird moving. It is not much of a problem in the local area where we know most of the procedures and frequencies by heart. But flying out of strange fields the problem may catch you off guard!

- At Base Ops get a good briefing on the sequence of radio contacts you will have to make during the departure and the probable frequencies. If this information is not available as a handout, write it down where it will be available for quick reference once you're in the aircraft.

- Do not try to make radio frequency changes immediately after takeoff! Wait until you have everything under control and sufficient terrain clearance (usually a minimum of 1000 feet.)

- If you are flying in formation, have a definite procedure to follow in case a wingman gets on a wrong frequency. One good idea is to have the wingman simply switch to a discrete pre-set channel. He can then wait until the leader gets a chance to contact him on that channel and give him the proper frequency. All pilots in the formation should leave their Guard receivers on in order to monitor emergency transmissions from either the controller or the flight leader.

Commanders, Operations Officers and Flying Safety Officers can monitor their operations to insure that everything possible is done to make departures easier for aircrews. They can:

- Have the AO or operations dispatcher brief all outgoing pilots on the sequence of radio contacts expected during the departure and the expected frequencies for each controller. Many bases print this information on the reverse side of the Form 175 and it should always be available in the SID booklet.

- Coordinate with controlling agencies (tower, departure control, center) to see if any existing frequency changes can be eliminated or simplified. At bases where traffic is generally light, clearances, taxi and takeoff instructions might all be given on one frequency.

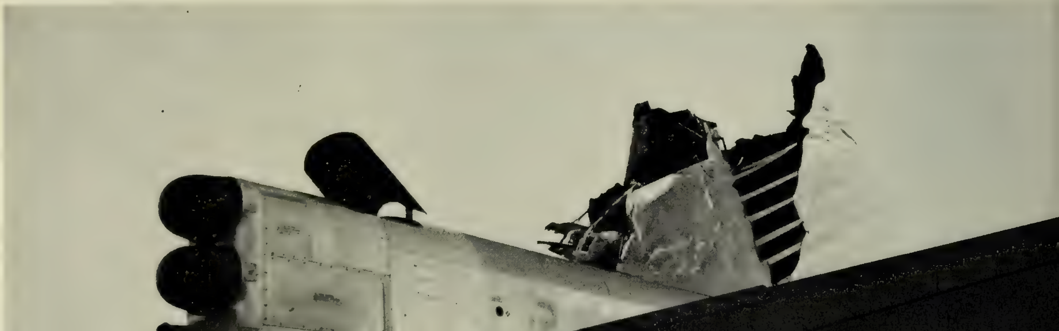
- If it is necessary for departing aircraft to contact departure control immediately after takeoff, have the pilots switch to departure control frequency before they start takeoff roll. They can monitor Guard for emergency instructions from the tower. This will eliminate one frequency change in a critical phase of flight.

- In some cases UHF frequencies can be made compatible to the point that a pilot has to change only one digit instead of four digits when changing frequencies (i.e., 285.6 to 285.7 or 286.6).

These are just some of the ways that IFR departures may be made easier. Some Air Force bases use all of them and most bases incorporate at least some of them in their departure procedures. But there are still some bases where a pilot is unduly taxed and edged toward an accident while making an IFR departure.

With the help of everyone concerned maybe we can keep the aluminum out of the tree tops during departures. ☆

something missing



Those who fly in Air Force aircraft owe much to the men behind the scenes—the designers and builders of those aircraft and to the men who push these machines to the limits of their design in the test programs. Testing is not confined to acceptance testing but continues on through the life span of the aircraft to determine ways of making it safer and to improve its mission performance.

On January 10 a Boeing test crew flying a B-52 was carrying out such tests when the aircraft was subjected to overstress induced by severe turbulence. The crew's reaction, the tremendous support from men on the ground and in the air, not only makes a fascinating story but demonstrates the ability of this aircraft to fly even with serious structural damage.

The narrative consists mainly of the account of the senior test pilot aboard, with added comments by the navigator and with a minimum of editorial assistance to provide continuity.

The story begins with the crew flying a highly instrumented B-52H to obtain dynamic structural load data on a low level mission in the mountains of Colorado.

Prior to the incident all aspects of the flight were normal in accordance with the mission profile, until turbulence caused the crew to curtail low level flight. The aircraft was then climbed to a higher altitude where the air was smooth. Then, in the words of instructor pilot Chuck Fisher,

“This is a real rough portion of the route in that it's a north track on the east slope of the Sangre de Cristo Mountains. Our experience has shown the prevailing westerly winds make it more susceptible than other routes to low altitude turbulence from high surface winds or mountain wave effects. When we abandoned the low level contour portion of the flight we pulled up to an altitude of about 14,000. Dick Curry *(test pilot, Richard Curry, in the left seat)* was flying the airplane and I was calling the signals when we ran into some real smooth air. In fact, it was so smooth as to be of no use from the loads survey standpoint. We elected, since we were going to overfly the low level course at this intermediate altitude, to run through the 350 knot condition at 14,000 feet altitude.

“From this relatively smooth air we hit what I would term near catastrophic turbulence.

“The encounter was very sudden and lasted only about five seconds. *(The data showed 9.6 seconds.)* I earlier estimated three seconds, but after talking it over with the crew we decided it was longer. During the first part of the encounter, the airplane appeared to be stable in that it wasn't moving in roll nor particularly in yaw and there wasn't anything on the instruments that would indicate anything more than normal excursions. As the encounter progressed we received a very sharp edged blow which was followed by many more. As the first sharp edged encounter started bleeding off we developed an almost instantaneous rate of roll at fairly high rate. The roll was to the far left and the nose was swinging up and to the right at a rapid rate. Immediately I reduced power to idle and the airplane started rotating nose-down at the same time.

“During the second portion of the encounter the airplane motions actually seemed to be negating my control inputs. I had the rudder to the firewall, the column in my lap, and full wheel and I wasn't having any luck righting the airplane. I applied airbrakes. In the short period between the first and second encounters, I gave the order to prepare to abandon the airplane because I didn't think we were going to keep it together. By the time we got through the second portion of the encounter I was sure that we had lost the rest of the airplane and we were in the 41 Station by ourselves, because nothing seemed to be working. Well, that's not true, either. The airplane didn't want to climb and power seemed to aggravate the lat-

Boeing crew who successfully landed disabled aircraft, top to bottom, Instructor Pilot Chuck Fisher, Pilot Dick Curry, Navigator Jim Pittman, Copilot Lee Coers.

eral directional oscillations. The roll authority available was exceeded actually by certain combinations of power and motion. We had a certain cyclical motion going also, so I was hesitant about aggravating this motion with thrust. It required about 80 per cent left wheel throw to control the aircraft by this time. We got down to about 250 knots quite rapidly and then continued on down to 225 knots. I shoved Curry the checklist and he looked up the minimum recommended flaps-up, and we figured to stay at least 30 knots over this. This was 310 KIAS so we further reduced our speed. I couldn't get the airplane to climb or turn to the right. We were heading north and wanted to go east. We worked around there eventually. We were getting some kind of blanking effect on the controls making a right turn difficult. This right turn actually turned out to be the poorest way to go. We would have been better off with a 270 to the left. I lowered the airbrakes to position one because of the limited amount of power I was using. This seemed to relieve the situation and was better than what I had used for recovery as far as controlling the aircraft. It still required 40 to 50 per cent of wheel throw to hold the wings level.

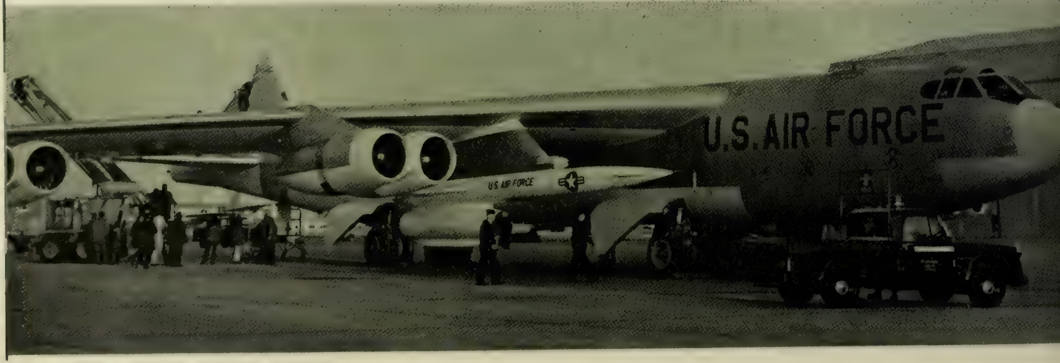
"At this time we had everybody in the seats. Our absolute over the ground was down to about 5000 or 6000 feet, and we needed a little altitude. So we climbed up—slowly up to 16. In the meantime we went to Guard and talked to Trinidad Radio. They vectored a B-52 in our direction. It was Firm 13. They were on an RBS run with 150 seconds to go and they broke off and came over. *(Firm 13, a SAC aircraft, assessed turbulence at different altitudes and advised that there was no turbulence at 10,000 feet. The aircraft then descended to that altitude.)* We never did rendezvous with them but we really appreciated their help: the information they furnished on the absence of turbulence at the lower altitudes since we were encountering light to moderate at our altitude. We felt we couldn't tolerate any with our control problems. Finally the pitch response of the airplane seemed to improve except for minor excursions. We would be in good shape and be holding 210 knots and the airplane would pitch or it would tuck in response to control. When this occurred control was very marginal. We still didn't know exactly what was wrong. We kept trying to figure out some reason for our control problem; we had all eight engines and all leading edge structure. We had everything we could see. We came to the conclusion that we had really ripped up the tail; and because of the continuous change of feel and vibration on the airplane we didn't hold out for much hope of getting it in a landable condition. But we headed for Wichita.

(Help appeared in the form of radar following by Denver Center and an F-100 flown by Boeing Chief Experimental Test Pilot Dale Felix who assessed the damage and reported it to the crew.)

"As soon as we got into a range where we could rendezvous with a Boeing-Wichita airplane, Dale Felix came up in a fighter and reported our damage. Dale informed us that most of the vertical fin was gone but the horizontal stabilizer was intact. We were relieved to know that we still had an operable stabilizer and to know that we also had at least one elevator that was in good working condition. There was no other observable damage to the empennage and all we really had to contend with was the asymmetrical yaw contribution of the remaining stub of the vertical stabilizer.

"During the three-hour burndown period, while orbiting the local area, we performed stability and control checks. Control of the aircraft even in optimum configuration was extremely difficult; but we felt that adequate margin would be available to land the aircraft under ideal conditions. Due to unfavorable surface winds, turbulence, and populated approaches at Wichita, it was decided to land at Blytheville. All of these conditions were considered favorable there. A final flaps-up landing configuration was determined to be most suitable because of

With most of vertical stabilizer gone, B-52 was landed at Blytheville, Ark. Outstanding support by men on the ground and in the air contributed to safe landing.



the higher approach and touchdown speeds. Of primary importance was the lateral directional instability present in the aircraft. We did go to 40 degrees on the outboards and the airplane then was power trimmable in that we could set up zero sideslip and fly the airplane. However, this wasn't too comfortable because, as Jack *(Chief of Flight Test, Jack Funk)* pointed out on one radio transmission, there would be very little damping for the near zero sideslip angles. We discovered that the lateral directional stability margin was aided if the aircraft was flown in a slight sideslip and that oscillations could be minimized by some small sideslip angle. We accomplished this by decreasing very slightly the power on engines 7 and 8. Flying with outboard airbrakes set at the number four position increased the directional stability.

"An aft C.G. was severely destabilizing the aircraft, and we found that a forward shift of C G. was advantageous in assuming a better lateral directional control condition. This was confirmed by Boeing Engineering, and we moved the C.G. forward to about 21 per cent MAC. The shift was accomplished by transferring and burning out fuel from the aft body tanks and 1 and 4 mains. Outboard airbrakes aided the control problem since these airbrakes are aft of the center of gravity. All these steps made the aircraft more stable, and airspeed was maintained at 210 KIAS. It was further decided by all technical advisors and ourselves that it would be best to lower the aft gear to improve lateral directional stability.

"We proceeded to Blytheville with the T-33 and KC-135 escorting us. *(Captain Samuel Kishline of the Boeing-Wichita AFPRO flew the T-Bird. The KC-135, with engineers was flown by James Adams of Boeing.)* Prior to our flight down there a B-52, flown by Major Fred Saunders and Captain Mert Baker, made a trial run at the altitude block we had been using to check the turbulence levels. Turbulence appeared non-existent.

"Arriving at Blytheville we lowered the rest of the gear. The front main gear made flying kind of tricky when it came down and we got several yaw excursions, but only during the transition up to down. Once it was down we were in real good shape. We still had to hold left wheel throw for wings level and if we tried to turn to the right the airplane would yaw quite severely to the left. I had the feeling that if you got the right wing down, the tail would just fall down the bank angle, so to speak. When turning to the left the airplane would also yaw to the left, however the excursion and sideslip was not as great as it was in the right bank. This phenomenon made the right turns real hairy because you would have to actually go to a pretty steep bank angle to get an appreciable right turn. We ran several checks before landing. Ray McPherson and Ted Slack were aboard the KC-135 and helped with the gross weight and C.G. Steve Starch calculated our 40-degree outboard contribution for body angles so that we wouldn't over-rotate on touchdown. We had good support all the way to touchdown.

"After we ran the checks I notified the people and they were satisfied, so we set up a wide pattern to Runway 17 at the base. We checked the steering and had a normal indication. The landing was not my best one, but the airplane was drifting left off the runway and the only way to stop it was to get it on the ground. Curry actuated number six on touchdown and we popped the chute at 130. Our weight at touchdown was 250,000 pounds. We touched down at 158 knots on my indicator. The calculated stopping distance was 5000 feet, that's with no chute, and we didn't have any problem whatsoever being ready to turn off at the first intersection."

(Navigator James Pittman now gives an account of the severity of the turbulence encountered.)

"I had been out of my seat prior to the occurrence and I sat back down while we were climbing. When this event occurred I was preparing to make an AUTO FIX with the BNS system and it was so violent that I was literally picked up and thrown against the left side of the airplane and forward up over the nav table. The winds just prior to the strike, although we were smooth, were building up and to the best of my ability to recollect, were in the vicinity of 65 knots out of the west and about 27 knots out of the south. The impression I got was that somebody reached down and took ahold of the airplane and was shaking it."

The aircraft, which was highly instrumented, was struck by severe clear air turbulence of mountain wave origin. Data are being analyzed to determine the true magnitude of the gust strike.

This incident, hazardous as it was, will pay off many times in the knowledge gained. It also points to the fact that we still do not really know the magnitude of the forces with which nature so often confronts us —a reason for scientific testing, as was being done on this flight. ☆

PROPELLERS

When the Wright Brothers made their first powered flight at Kitty Hawk they obtained thrust from propeller blades. Sixty years later the Air Force still operates over 5000 propeller-driven aircraft. Despite all this experience, propeller malfunctions continue to occur. In some cases these malfunctions are of such magnitude they can literally tear prop assemblies apart, ripping away nose sections of engines and slicing into wings and fuselages.

Not in all cases, but usually, there is an emergency procedure that permits the aircrew to control the prop in such a way that a safe landing can be made. It is because of the seriousness of some propeller malfunctions, more than the frequency, that this article has been prepared. It is an attempt to trace propeller development and problems and present the best information available on dealing with propeller problems.

To recap, briefly, the first propellers were made from one piece of wood. The blades were carved in such a way that each presented the same airfoil as the prop turned about the hub. The prop was fastened to the engine drive shaft, either directly or through a gear and shaft arrangement. When power was applied the propeller literally screwed (propellers are still called *airscrews* by the British) its way through the air, dragging or pushing the aircraft along.

These early wooden props were made in different shapes; some were laminated and some sported metal caps along the leading edge. Actually, they were also quite trouble-free, as long as they were in balance, made of good sound wood and the tips didn't strike obstructions on the rough landing fields.

Durability was increased further when metal props were developed. This period, from a reliability standpoint, was probably the safest period insofar as propellers are concerned.

These fixed pitch propellers were a compromise. The blade angle had to be flat enough to allow the engine to be revved up to full speed for takeoff, yet there also had to be enough bite left to produce a reasonable cruising speed at reduced power during level flight. (Fig. 1)

A tremendous increase in efficiency would result if a variable pitch prop could be devised—low pitch for takeoff and climb, a higher pitch for cruise. Such a propeller was devised. (Fig. 2) It worked fine, but added to the complexity in the cockpit. There had to be a prop control. And now some new prop malfunctions were encountered. Sometimes the prop would overspeed, causing engine RPM to exceed limits. Slight overspeeding became common, especially during stalls or other low-airload maneuvers, particularly if power were applied at the time. (Fig. 3)

One of the next developments was feathering capability. When malfunctions occur, either to prop or engine, if the engine can be shut down and the prop blades angled into the airstream until ram air forces on both sides of the blade are equal, rotation of prop and engine will cease and drag will be at a minimum. Full feathering propellers were devised. (Fig. 4)

For discussion of engine failure we should consider that there are two types of reciprocating engine propellers used by the Air Force. These are identified as (a) those which use the engine oil for propeller control (C-118, C-54, etc.) and (b) those which use their own independent oil system (K/C-97, C-119, SA-16). If an engine failure should occur with the (a) configuration, two possibilities exist:

(1) If the engine oil supply to the propeller governor remains available and uncontaminated the propeller will continue to govern at whatever RPM the pilot has selected.

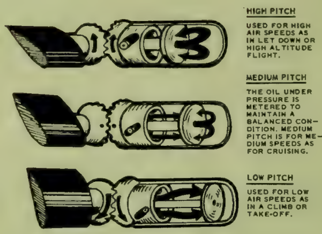
(2) If the engine oil supply to the governor is blocked or contaminated the propeller governor will probably lose control resulting in the blades moving to the low pitch stop. If the propeller incorporates a pitch lock the blades will lock pitch at the blade angle which produces the overspeed setting of the pitch lock system. The ability to feather for possibility (1) is very probable. For possibility (2) it is possible depending on degree of contamination and oil available to the feathering pump. In both of the above possibilities for propeller configuration (a) there will be drag, however, a potential runaway exists only for possibility (2).

If an engine failure should occur with the (b) propeller configuration the propeller will continue to govern normally at whatever RPM is selected by the pilot. The propeller can be feathered. There will, of course, be drag because the propeller is absorbing energy from the airstream.

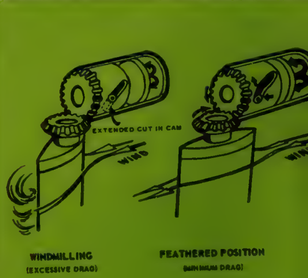
Should the prop stop, as could occur if the engine

An early vintage fighter sports a fixed pitch wood propeller; simple, but most inefficient by today's standards.

Fixed Pitch Prop


HIGH PITCH
USED FOR HIGH AIR SPEEDS AS IN LET DOWN OR HIGH ALTITUDE FLIGHT.
MEDIUM PITCH
THE OIL UNDER PRESSURE IS METERED TO MAINTAIN A BALANCED CONDITION. MEDIUM PITCH IS FOR MEDIUM SPEEDS AS FOR CRUISING.
LOW PITCH
USED FOR LOW AIR SPEEDS AS IN A CLIMB OR TAKE-OFF.

Variable Pitch Prop



Prop Feathering

bearings freeze, drag would be further increased. Each molecule of air is deflected less in getting by a moving blade than a frozen blade. Drag of both turning and frozen propellers is less at higher blade angles, but, of course, a prop must be at a low blade angle to overspeed. There is a cross-over point for drag of a rotating propeller versus a frozen propeller, however, this cannot be generalized by calling out specific blade angles as there is too great a difference in the method of specifying blade angles among different propeller blade designs.

With increases in aircraft speeds, cruising altitudes and use of variable pitch propellers, overspeeding when the aircraft was being operated at high altitudes and speeds posed an increasingly greater threat to safety.

As aircraft became faster and heavier it was reasoned that, if the prop blades could be turned through flat pitch and to a reverse angle and power applied, this procedure would aid in stopping the aircraft after landing or in case of a takeoff abort.

Reversible props were next. (Fig. 5) Now the blade angle range had been extended from full feather to reverse. Excellent, performancewise, but more malfunction headaches. When propeller control was lost the blade angle would usually go to normal low pitch, but sometimes below. If the blade angle flatted to low pitch and no prop control could be regained it might not be possible to keep the crippled airplane from turning into this prop or keep the prop within maximum RPM limits.

In all Hamilton Standard propellers the low pitch stop is the only mechanical stop other than the full feather and the full reverse stops. In the turbine engine propellers there is also the mechanical pitch lock which engages as a function of RPM somewhere above the low pitch stop and feather blade angle. The low pitch stop is not necessarily above frozen/windmilling drag crossover point for all installations.

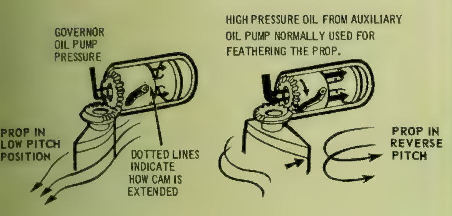
In addition, and as a measure to prevent inflight reversals, various throttle pedestal safeguards were installed. A common design practice is to require the operator to manually move a reverse lock device to energize the reversing mechanism. Most installations are also inoperative until the weight of the aircraft closes a microswitch on a main gear.

In later model recip aircraft and in turboprop aircraft power plants became more powerful and prop size had to be increased to handle the torque output of the engine. Now, due to prop size, higher altitudes and higher airspeeds it became necessary to add another safeguard. Something had to be done to prevent the uncontrolled, high speed runaway. If not, the prop would tear itself free, possibly ripping a wing loose, before the aircrew could take effective action to bring the emergency under control.

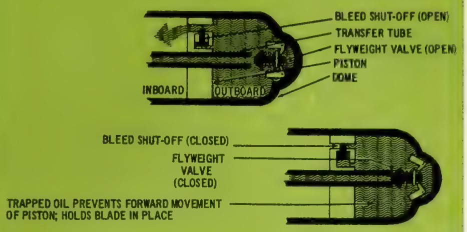
This led to the mechanical pitch lock. With this system, when normal prop governing fails and the prop tends to go toward flat pitch and overspeed, there is a device that senses the overspeed and automatically locks the prop in whatever position it has reached (just a few degrees blow its normal setting). When this happens RPM is controlled with the throttle—forward more power and higher RPM; back, less power and lower RPM. In this condition the pilot is back in the fixed pitch configuration reminiscent of the Wright Brothers days. He has a livable situation that will permit him to reach a lower true airspeed (lower altitude and indicated airspeed) and a suitable landing field. Normally the procedure is then to feather the prop and land. Should prop control be completely lost during the process, true airspeed will be low enough (unless the aircraft is extremely heavy) to permit the propeller to rotate at less-than-destruct speed.

Before attempting to detail common prop problems and what to do about them, a differentiation should be made between overspeeds and runaways.

Overspeeds are momentary surges in RPM, as can occur with rapid forward throttle movement during periods of relatively light airload, and possibly from momentary prop control adjustments. If the overspeeds are not pilot induced, or if they are and subsequent surges occur, they should always be written up in the 781-2 so



Prop Reversing



Pitch Lock

the system can be carefully and completely checked out by a propeller specialist.

A runaway is a condition in which RPM exceeds normal range limits and is not controllable by governor action. When a runaway is experienced there is always a high drag situation.

Following are some common principles—true of all propellers during a runaway condition:

- Windmilling speeds are directly proportional to true airspeeds and drag increases on the order of the square of the velocity. The lower and slower the aircraft can be flown, the lower the true airspeed and the drag.
- Once true airspeed is reduced to a minimum safe control margin above stall, runaway RPM will likely be within maximum RPM limits, especially if the propeller has pitch locked.
- If power is not required from the affected engine in order to maintain flight the prop should be feathered and the engine shut down.
- Very possibly, in the case of a true runaway, all control, *including feathering,* will be lost.

In critical flight situations (on takeoff) it is probable that some positive thrust can be realized by flying the aircraft at minimum safe control speed and adjusting the throttle to stablize RPM at max allowable limits. If some degree of positive thrust can be attained in this manner there is less danger of engine damage than when the propeller is driving the engine, as in a power off runaway condition.

A high-pitched, piercing whine will be very noticeable when a prop runs away. This sound alone is conducive to some degree of panic and thorough knowledge of all propeller malfunctions and what to do about them is the best insurance against hasty, but incorrect, actions at this time.

Unless structural concerns require (extreme vibration, loss of oil, fire or nose case discoloration from heat) or unless controlled flight cannot be maintained at low true airspeeds, *do not freeze the propeller.* If an uncontrollable propeller decouples it will be essentially unloaded and its RPM is limited only by its blade angle (pitch locked at a higher blade angle or on the low pitch stop) and aircraft true airspeed. Such resulting RPM could be high enough for the propeller to destroy itself. If freezing occurs abruptly the prop may leave the aircraft, striking the adjacent prop, the wing and the fuselage. (Should RPM gradually or sporadically reduce during this process, attempt to feather—turning moment forces may have been reduced enough for feathering pressures to be effective.)

If freezing is imminent, either intentional or otherwise, and flight conditions permit, consider feathering the propeller on the adjacent engine until freezing has occurred. If the adjacent engine and prop escape damage the engine can be restarted.

Summarizing, for reciprocating engine aircraft, here are procedures designated to counteract a runaway:

1. Slow down to minimum true airspeed.
2. If safe flight can be maintained, feather. If the propeller will not feather, then:
3. Check RPM. If the RPM is within maximum allowable limits, the propeller has either pitch locked or is against the low pitch stops.
4. Advance the throttle for the affected engine to not exceed maximum continuous allowable RPM (take off RPM for a short time if needed to climb over obstructions). A positive thrust condition (determinable from the torquemeter) will probably result.
5. Land at the nearest available field.
6. If level flight cannot be maintained under the above conditions and a crash landing is imminent, level the wings and comply with Dash One crash landing procedures. Reduction of power on the opposite side may be necessary to level the aircraft wings.

An article in a forthcoming issue will deal with turboprops. Because they must harness more power than the props on reciprocating engines, and are therefore more critical when prop control difficulties are experienced, they must receive special consideration. ☆

THE

It was when C. Z. Chumley bit down on the dry, hard piece of toast and recognized that horrible burned taste that he really went into a neighbor-waking tantrum. There is a limit. He had overcome the urge to throw a shoe at the rasping, insistent electric alarm clock that had tortuously pulled him from a sound sleep in the grey half-light of morning. He had managed to smother a kid-waking epithet when he had jammed his right index toe on the corner of the bed en route to the alarm clock. He had even managed to blind stagger his way to the linen closet in the hall when, after emerging from the shower, he had made the soapy-eyed discovery that there were no towels in the bathroom. Yup, he was getting in great shape for an early morning flight with a bunch of VIPs in the back and a new copilot at his side.

He turned to his curler-topped, shapeless-gowned ever-lovin' and stormed, "When'd 'ja put this toast in—last night!"

Mrs. Chum, not overjoyed at having to get breakfast at this hour anyway, simply slipped a fresh piece of bread in the toaster. Her version was not "ever-lovin'," it was "ever-sufferin'."

"Don't'cha remember that safety meeting for the wives when they told you how important it is for a pilot to have a good healthy breakfast and start out on a flight all relaxed and happy?" her husband asked through a mouthful of soft scrambled.

Not that again, Mrs. Chumley thought, but she resisted the temptation to make an acid comment on how she had spent a night next to the snoring champion of the Air Force. "Yes, Dear," she said. She had long since made the evaluation that, next to "Yes, sir," there was nothing that sounded better to her Air Force officer than, "Yes, Dear!"

Fed, coffee'd and dutifully lip pecked, Chum's ever-sufferin' got him out of the house on time. Some-

VER~SUFFERIN’

day though, she promised herself, she was gonna tell him. She'd trade him for that cushy job where he even has a guy to pull up the wheels, do all the navigating and radio calling while he sits there and steers. Let him whip up breakfast at 0400 sometime, especially for an unappreciative mate who goes through the meal with triple threat monotony—grunts, grumbles and morning paper reading. She'd have him get up three times in the night to let the dog out, and three more times to let the miserable mutt back in. She'd let him worry with a youngster with a bellyache. Then, when he was in bed, she'd keep him from going to sleep by having him be committee chairman and do some desperate thinking on how to decorate the club for the next wives' luncheon. But for now—and when she heard the familiar snarl of the Jag's exhaust as The Great One upshifted his way out of the Capehart area—she slid into an ungainly sprawl in a kitchen chair and took the first leisurely sip of a half-cup of coffee.

And when she went back to bed she couldn't rest. She had let herself become worked up over the subject of Air Force wives' inequities, and suffered a terrible nightmare:

She had on some sort of strange, filmy robe, and she stood behind a pulpit sort of arrangement. She was making a pitch; the surroundings were unfamiliar, but the speech seemed perfectly natural. Her audience, too, was as it should be—aircrew members.

"One thing," she was saying, "most of the rules you go by were made up by a bunch of military pilots who wanted their cake and wanted to eat it too. For instance," and there was considerable fervor in her voice, "you think you can drink and mistreat yourselves all week, then the night before you go on a flight you lay off the booze and go to bed early. Does that few hours completely refurbish the old body? Not on your life." She pounded the lectern with each word. "If you'd reverse the procedure—live like boy scouts six days of the week, then have that martini or two before dinner on Saturday night, you'd be much better off. You might then be as robust as you like to think you are.

" 'Nother point." It seemed like she glanced at a note, but that would be ridiculous. She didn't need any notes for this. "You have a lot of pride as to your physical prowess; and that's about all it is—pride. For five days you are so weary you have to ride the elevator to go a single flight of stairs, you wouldn't think of walking two blocks to work, you're so tired that at night it's all you can do to drag yourselves from the TV couch to the bed, then;" she paused, sweeping her audience with scorn, "comes Saturday. All at once you are berserk dynamos. All week your wives have had to coddle, plead, beg, threaten and shake to get you out of bed at seven. Now, at five o'clock you are bounding around, singing off key in the shower and hunting in all your drawers for things you dropped all over the house last Saturday. You can't understand why the little woman isn't overjoyed to be bustling around in the kitchen fixing you a mammoth breakfast that will last you through eighteen strenuous holes of golf."

She was in full cry now—the urgings of years finally coming to the fore. "You racket around, waking the kids, getting the dogs excited, torturing your poor wives; then, when you've accomplished all this, you happily tear off to the links. There you flail away at defenseless little balls, drag unoiled carts up and down hills, sweating miserably and puffing mightily because of the years' old cigarette habit and the oversized midriff."

Mrs. Chumley shook her head as in disbelief, then continued. "You suffer in pleasure, telling yourselves how good all this exercise is for you and, in your mind's eye, picturing yourselves as budding Palmers. You become more and more mentally maladjusted as the morning wears on, due to unjustified ill fortune that deals you bad shots frequently." She paused and took a drink of water to settle herself before proceeding.

"Saturday afternoon then, after a morning of exertion, you cry like wounded bears if your ever-sufferin' asks you to do some monumental task—raise your feet while she sweeps, f'rinstance.

"One thing all wives agree on—I've attended enough wives' luncheons to be certain of this—the only sure way to keep you even semi-civil is to have plenty of beer in the refrigerator and a football game on TV."

Mrs. C. paused, sweeping her audience with frigid eyes. Many, she noted, were squirming.

"Let's go on. Our fervent hope is that you will do what comes naturally—fall asleep in your oversized, overstuffed, tilt back ottoman. 'Guardians of the peace' doesn't apply to you alone—it applies to the wives who keep the offspring out of doors and out of earshot on Saturday afternoons."

She thought she caught a question, and tilted her head to hear better before replying. "What's all this got to do with accident prevention? More than you think. Wives might just be the best safety officers in the Air Force. The housewife is the only specialist in the world who has the patience, the fortitude and the raw courage to, weekend after weekend, ride herd on the prides of the Air Force and turn them back again Monday morning, blue-suited and flyable."

She paused and looked at her audience. "Questions . . . any questions?"

The last words were clearly audible and they jarred Mrs. C. back toward the reality of the kitchen and the smell of burning toast. A small, half-awake voice completed the transition for her.

"Mommy, Mommy—I got a question. When's breakfast? I'm hungry." ☆

"Be afraid, gentlemen, it's a natural reaction," is advice of MSgt Anthony Martino, NCOIC, Hamilton survival school. Below, student "ejects" from 20-foot jump tower during training. Course includes practice sessions in helicopter pick-up and correct landing procedures. Students, all veteran pilots and radar observers, are from 25th and 28th Air Divisions. (USAF Photos by TSgt Dave Mayhew.)

TRAINE

Pilots reporting to the 28th Ai
Division Survival School at Hamil
ton AFB take a look at some of th
equipment that is used in their train
ing and begin to wish they wer
somewhere else. But after it's al
over they are glad they stuc
around for the whole course.

The school is operated by a tri
of sergeants who have a total c
more than 40 years of parachutin
experience. The boss is MSgt An
thony Martino who has spent 10 c
his 12 years in the Air Force in res
cue and survival work. Assistin
him are TSgt Tommy Cox an
SSgt Noel Crowson.

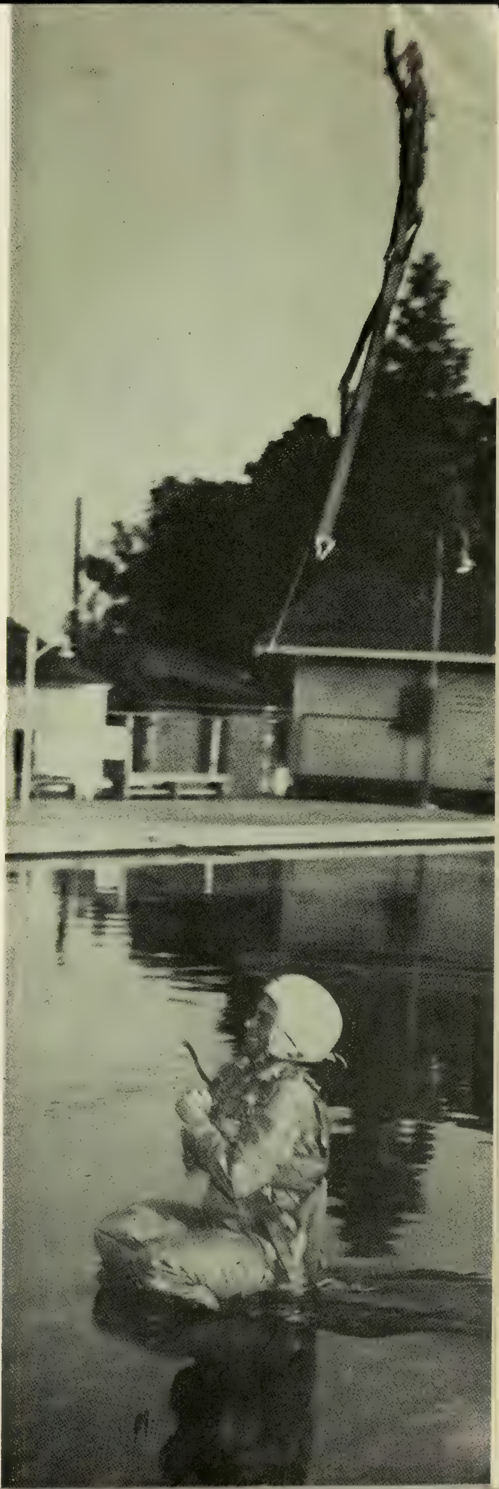
SSg

Above, left, HIT THE DIRT! Student learns how to land and roll, following emergency bailout. Training is conducted off 4-foot platform into sawdust pit. Above right, BLAST MACHINE—a converted Swamp Glider—is used primarily to give students effect of being dragged when landing after emergency ejection.

TO LIVE

Packed into the one-day school is
aining on ejection procedures
escent and landing techniques) as
ll as water survival. The school
fast, thorough and rough. Its ef-
ctiveness is testified to by aircrews
at have had to eject from their air-
aft. One pilot put it this way:
Because of this training, I was ex-
emely well prepared for all phases
the ejection sequence and subse-
ent descent and landing. All fly-
organizations would benefit
eatly from a similar program."
The pictures on these two pages
strate equipment and methods
ed at the school.

y, Survival School, Hamilton AFB, Calif



Above, water survival instructions are pointed out by TSgt Tommy Cox. Life rafts are boarded after students are dropped into water from a 16-foot tower, inflating life preservers upon impact. Right, GERONIMO! Pilot grimaces just before getting full impact of a 16-foot drop into 10 feet of chilly water.

Testing the Talon

Larry A. Roberts, Directorate of Flight Test Operations, ASD

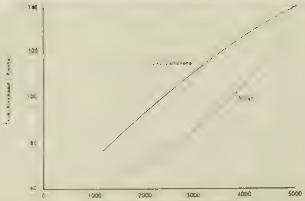
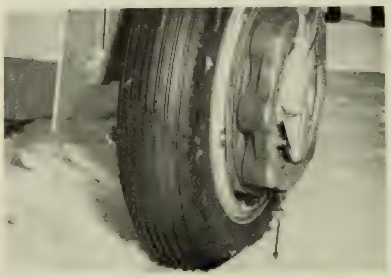


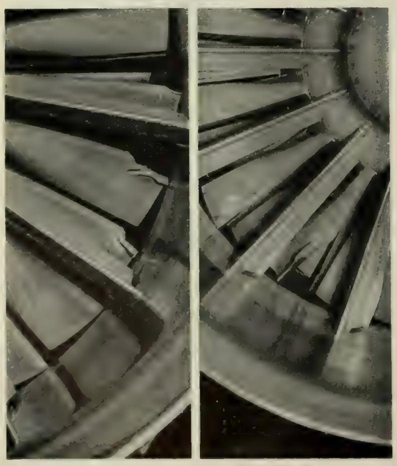
Figure Comparison of Stopping Distances for Slush and Dry Concrete



Tire damage caused by locking wheel during braking run on slush.

Above photo shows dents in the bottom of left flap caused by slush thrown from main gear.

Below, ice ingestion damage to left and right engines.

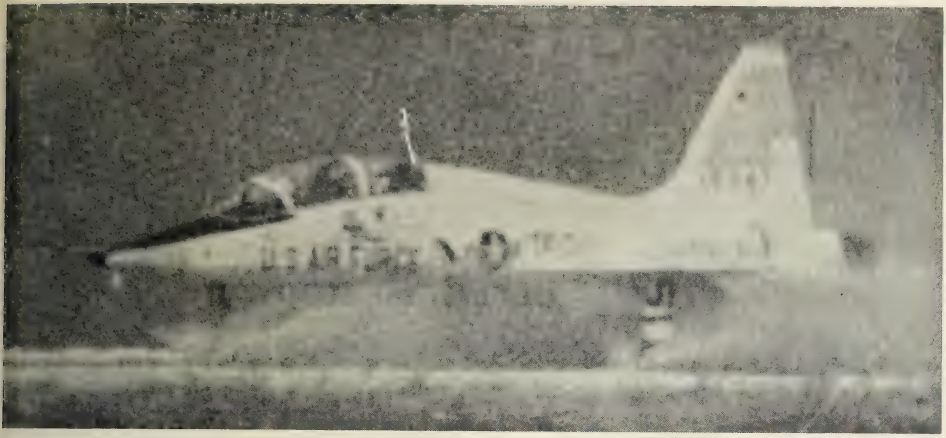


In order to determine stopping and handling characteristics of the T-38 trainer on various types of slick runway surfaces, the Aeronautical Systems Division's Deputy for Flight Test ran a series of tests with a Talon at Wright-Patterson AFB, Ohio, and in the surrounding area.

Taxi runs at speeds up to 120 KIAS, made at one of the test sites, yielded operational data of particular interest to a pilot faced with the necessity of landing on a slush covered runway. The runway was covered with a layer of slush approximately one and one-half inches deep, on the average, and characteristically varying in density and composition from place to place.

The directional control of the Talon, on slush, is marginal. Differential drag, caused by one wheel rolling through a deeper puddle than the other, etc., creates a considerable workload for a pilot as he fights to counteract the resulting yaw. This situation is further aggravated by slush, sprayed from the wheels, impinging on the flaps and airframe. The inboard half of the spray pattern from each main wheel strikes the outboard end of the flap and the subsequent Newtonian reaction generates the maximum possible yawing moment. Above 70 KIAS the rudder is the best means of maintaining directional control.

A comparison of the Talon's stopping capabilities on slush and on dry concrete is contained in Fig. 1. The curve for stopping distance on dry concrete is conventional in shape and conforms to theory. The curve for stopping distance on slush, however, exhibits some interesting differences, the greatest of which is the concavity upward rather than downward. The reason for this is that slush drag, like aerodynamic drag, is proportional to the square of the velocity. Therefore, the retarding force exerted on the wheels by the slush increases exponentially with increasing speed. In other words, slush drag at 100 knots is four times greater than it is at 50 knots because doubling the velocity increases the drag by a factor of four. Consequently, rollout distance does not increase in proportion to increasing speed. If the possibility of hydrodynamic planing is neglected and the slush curve is extended to 140 knots according to its established trend (see dotted portion of curve in Fig. 1), it would intersect the dry concrete curve. Thus, from touchdown speeds, rollout distances on slush might com-



Slush sprays from wheels during a taxi run. Spray from nosewheel is reaching engine ducts.

pare very favorably with those for a dry runway.

The maximum speed reached during the test was 120 knots and no noticeable planing occurred. Apparently, the small footprint of the tires enables them to cut through almost any surface covering but ice. It is not known at what speed the T-38 will begin to plane, or if it will plane at velocities below takeoff speed. However, the landing speed envelope extends from 120 to 140 KIAS and if the planing speed of the aircraft is above the touchdown speed for a particular landing condition, certain adverse circumstances might result on landing. For instance, a large downward pitching moment might develop as the main wheels settle into the slush, or the gear might be damaged by the sudden application of high retarding forces on touchdown. These things would depend on the depth of the slush and the gross weight of the aircraft. At present there is insufficient data to make a judgment regarding operation in this region, but hazards may exist.

Tire damage, such as that shown in Fig. 2, can result from locking the wheel brakes during landing rolls on slush. The pilot has very little "feel" of the brakes on a slick surface and the wheels can be locked very easily. Even momentary skids can result in serious "ice burns" and possibly even blowouts.

Flap damage can also result from operation on slush (Fig. 3). The flaps are honeycomb structures and slush, sprayed from the main wheels, can dent them very easily. No other airframe damage was observed during the test.

The most serious problem encountered was that of engine ice ingestion. At speeds of 40 knots and above, slush, sprayed from the nose wheel, was slinging high enough to enter the engine ducts (Fig. 4). Some of this slush was impinging on the inside walls of the ducts and freezing. Finally, after several runs, the accumulation of ice was sufficiently large and, when broken loose by vibration, aerodynamic forces, etc., entered the engines. As the ice entered the first compressor stages the blades, because of their pitch, deflected forward and struck the trailing edges of the inlet guide vanes. The resulting damage is shown in Figs. 5 and 6. A piece of metal tore out of one of the blades of the left engine (Fig. 6) and ingested also, causing extensive damage to other blades throughout the compressor section.

A similar situation occurred during a test in 1959. A T-38 was taxiing in slush six to eight inches deep. It reached a speed of about 50 knots. The engines were ingesting slush in such large quantities that they flamed out before the run could be completed. Both compressors were badly damaged.

The results of this test gave a definite indication of problems which would be attendant to T-38 operation on slush covered surfaces. These problems might be more or less acute as the slush depth increases or decreases. To summarize, from touchdown speeds, tests on a runway covered with slush one and one-half inches deep showed that:

a. Directional control can be maintained but it is marginal.

b. Stopping distances compare favorably with those for dry runways.

c. Tire damage from skidding is a definite hazard if wheel brakes are locked during the rollout.

d. Flap damage from impinging slush will result.

e. Engine ice ingestion is a virtual certainty and compressor damage is highly probable.

Operation of the T-38 on slush seems inadvisable on the basis of items c through e. ☆

The successful demonstration of heavier than air flight at Kittyhawk was a long way from the aviation world of today and many painful lessons had to be learned. The path of the history of flight is marked by broken machinery and aviator's heads. The possibilities of space flight have already been demonstrated and there is little doubt that the future will see a growth in the use of space flight to rival that of the aircraft. The challenge facing those currently involved in manned space programs is to advance space technology without reliving those painful lessons.

It is something of a surprise to many that we in the Air Force are directly involved in the Gemini program. Although NASA has the overall management of Gemini, the Air Force is responsible for the engineering and procurement of the launch vehicle, activation of the launch complex and for providing the launch services at Cape Kennedy.

The basic launch vehicle is a Titan II, an operational weapon system in the Air Force arsenal. But while the Titan II has the performance potential to lift the two man spacecraft, the design criteria for a weapon system are quite different from that for a manned booster.

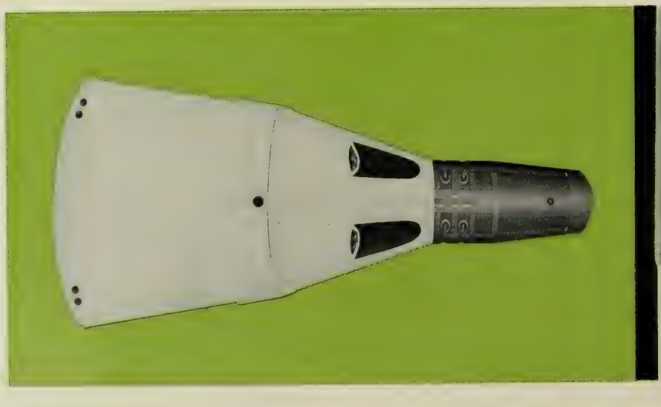
A common misconception is that all that is required to convert a basic Titan II to a Gemini launch vehicle is to make up a cockpit of sorts, complete with oxygen mask and seat belt and bolt it on. Unfortunately, it just isn't so.

There is little question that the mission requires 100 per cent reliability. But over 50 years of flying experience has taught us that such a goal will not be achieved in the foreseeable future. What we are trying to do is to raise the reliability through every practical means to a maximum and then bridge the remaining gap with a system that will detect a malfunction and allow safe escape by the astronauts.

The "man rating" of the booster is not a new technique. It follows the basic pattern used for the Mercury Project with additional elements which evolved from Mercury experience.

MAN~RATING THE GEMINI

Lt Col Robert J. Goebel, Space Systems Division



Lt Col Robert J. Goebel, of Air Force Space Systems Division's Gemini Launch Vehicle Directorate, examines model of Gemini and booster.

The first step is a total review of the system within the framework of the Gemini mission requirements. Not only performance capability but the entire system of drawings and specifications, tolerances, environmental levels, component subsystem and system tests are reviewed and altered when necessary. A ground rule was established very early that hardware changes were to be kept to a minimum. The Gemini program includes only two unmanned flights and depends upon the Titan II flight test program for validation of the basic design. Therefore every change from the Titan II configuration makes less valid the direct use of Titan flight test history for Gemini. Every change is carefully weighed by a contractor board and again by an SSD/Aerospace board to be certain that changes introduced to improve reliability and pilot safety don't in fact produce the opposite effect.

The studies resulted in the design and installation of a Malfunction Detection System capable of sensing and displaying to the astronauts in the shortest possible time those parameters which could indicate serious trouble. It monitors various launch vehicle subsystems, keeping the crew posted on operations and, in case of malfunction, provides a warning before the actual failure occurs. One type failure which could not be sensed in time to permit astronaut escape was taken care of by a redesign to provide automatic switchover to a backup flight control system.

Design improvements of the system would be worthless if the actual fabrication and checkout were not conducted in a manner to reduce or preclude human errors. Every pilot has been exposed to this in the form of loose fuel caps, empty fuel tanks, tools left in the engine compartment, etc. Gemini pilots will not be able to return to the launching pad for repairs and a few well chosen words to the fellow "who wasn't the regular crew chief." The aim is to have nothing but "regular crew chiefs" work on the program both in the factory and at the launch site.

Gemini production and inspection personnel are given special training including technical training, special training in Gemini procedures and disciplines and orientation on the total Gemini program. Successful completion of all requisite training results in the issue of individual stamps which identify the worker who performed the particular job. An important part of the program is to cultivate the desire of the workers connected with the program to do a superior job. This is done through a continuous motivation program on the importance of Gemini and the necessity for doing the job right the first time.

Man rating the manufacturing process is in some respects more difficult than man rating a system design. Besides the technical considerations of what can be done, there is the program office problem of what ought to be done. Each technique, procedure, control, etc. must be weighed in terms of its contribution to increased reliability and its impact on the program in terms of dollars and schedules.

Typical of the areas which receive additional emphasis for Gemini are contamination control, configuration control, tool control and discipline, time-sensitive component control, critical components control, special handling, and failure analyses. All of these have been applied in varying degrees to most programs. The significant point is the extent to which they are carried on in the Gemini program. As an example, all failures are reviewed in order to understand the physics of failure and to be assured that similar parts which may perform satisfactorily during test do not in fact contain latent defects which may cause a catastrophic failure. In all cases some corrective action is required before a failure report is closed out. The goal is to have all failure reports closed before the bird flies.

The acceptance testing of the vehicle consists of several mock countdowns and flights in the vertical position. Everything is done in actual flight except firing the engines. Data tapes from this vertical testing are reviewed in detail for unusual behavior in any black box. Any suspicious indication must be explained or the black box changed and test rerun. At the same time the entire history of the vehicle is reviewed down to the component level for any "skeletons in the family closet." Operating time logs are reviewed to assure that components were not run past their useful lives during testing. Inputs from the entire Titan program are evaluated in terms of the effect on the Gemini mission.

The same tender loving care provided the vehicle in the factory is carried over to Cape activities. Air Force personnel head teams of specialists who monitor all operations and tests performed on the bird from arrival at the Cape to launch.

Following the successful pattern set by the Mercury Project a Pilot Safety Review Board, chaired by Maj Gen Ben I. Funk, Commander, Space Systems Division, will make a final evaluation of the launch vehicle. This review will include a detailed analysis of the complete history of the bird from assembly to prelaunch. All difficulties will be reassessed, any open items weighed for impact on pilot safety and the final determination made whether to certify the vehicle as "man rated" and release it to NASA for launch.

While "man rating" is an important part of the Gemini program, it is also a key block in the larger picture of military space activity. The mutual exchange of knowledge resulting from our association with NASA will far go toward advancing our next manned space programs, leading to the day when space flights will be routine. ☆

ADC.FAA JOIN HANDS

Col Glen W. Clark, Air Defense Command, Ent AFB, Colo

Air Defense Command and the Federal Aviation Agency have begun combined operations in the Great Falls Semi-Automatic Ground Environment (SAGE) Direction Center at Malmstrom AFB, Montana.

FAA's new Great Falls Air Route Traffic Control Center will make joint use of ADC's operational facilities, computers, long-range radars and related equipment to provide air traffic control services to civil and military aircraft operating in approximately 135,000 square miles of air space over Montana and the western half of North Dakota.

The integrated air defense/air traffic control facility at Great Falls is part of the program designated Northern Tier Integration Project (NOTIP).

The overall control area extends approximately 610 miles West to East and 220 miles North to South. Joint use by FAA and ADC of long range radars for air defense, air traffic control high altitude civil jet advisory service and other related purposes has been under way for a number of years. This joint use program has proved to be efficient and economical, saving the government millions of dollars by avoiding duplication of facilities and equipment as well as overlapping functions. Location of the FAA facility within the SAGE center provides additional advantages not available until now in air traffic control. FAA use of the SAGE system will not affect current military manning nor interfer with air defense operations of the Great Falls Section.

Under the new concept, FAA controllers, for the first time in air traffic control, will have available processed digitalized data from a number of radar sites which will provide a composite picture of the air situation for the entire area covered by detection and identification systems. This data reaches the center via telephone circuitry. High speed computers combine the radar inputs from the various sources in micro seconds and display the composite picture on the controller's scope. The display is in the form of alpha-numerics, including aircraft identity, altitudes (both assigned and reported) and other information that the controller can call for electronically. The system also provides automatic tracking of targets on either primary or secondary radar, or a combination of the two; computer-generated radar hand-off displays and special alerting features.

Other important display features include such information as Air Defense Identification Zones, climb corridors and flight test areas, high and low altitude airways, aircraft trails, identity as to SAGE or FAA tracks, geographical boundaries and landmarks, and a common tracking system for the entire area. ☆

FAA operators receive an explanation on the new air traffic control system from Charles Irwin (pointing into the radar scope), chief, FAA, Great Falls Northern Tier Integration Project (NOTIP). New scopes using data from radar sites and processed by the SAGE computer in thousandths of a second will give FAA controllers information on the civilian and military air traffic situation.

Charles Irwin (third from left) receives first hand explanation on the operation of a SAGE Center from Col Jean H. Daugherty (second from right), commander, Great Falls Air Defense Sector (SAGE). Irwin or another FAA representative will be included on the battle staff during the simulated exercises.

MISSILANEA

SNAP, CRACKLE AND POP! While performing the CIM-10A roll bulkhead flush and bleed operation, hydraulic pressure was applied to the missle. The aileron movement snapped off the control surface lock, cracking and bending the left wing stub stringer rib. Although the appropriate technical order was being used as a checklist to perform the operation, the procedure to remove the control surface lock prior to hydraulic pressure being applied was obviously overlooked. As a result of this error, the following actions were taken:

- Standardization of minimum training required prior to an individual's operating the hydraulic station.
- Individual involved was re-trained under competent supervision.
- Acetate over T.O. pages is now used so that each item may be checked off with grease pencil as accomplished.

Major James C. Morrison,
Directorate of Aerospace Safety

CHECK AND SIGN OFF— During a recent forcible entry at an LGM-30 Minuteman Launch Facility, an old human failing, forgetfulness, was very much in evidence. Part of the prescribed gear to accomplish the task included a nitrogen gas bottle and connector kit. You have already guessed the fun part. When the kit was finally opened and the flex lines and hardware readied for use, it was discovered that an essential flex line and a required Allen-head wrench were missing. (The support base was only 50 miles distant.)

When are we going to use checklist and sign-off sheets as they are intended?

Lt Col Valdean Watson,
Directorate of Aerospace Safety

FROM SEA TO SHINING SEA. Across this great land of ours, the introduction of missiles into our operational inventory has created topographical changes. The first generation ICBMs caused unusual looking buildings to be erected, new access roads to be built, communication facilities to be expanded, and many blue vehicles to pass through little towns on a daily basis. The second generation ICBM complexes are not so easy to see, but the new roads were built in places which, to call them isolated, would be an understatement. Again, more communications equipment was installed and the same color vehicles go through out-of-the-way towns.

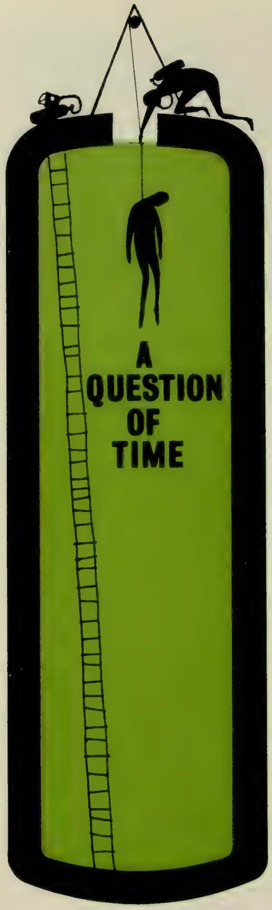
We have necessarily spent millions of dollars to build this missile system and, in doing so, have brought the Air Force to American people who in the past have never been in contact with us. In spending this money we have obligated ourselves, you and I, to spend it wisely, get the most for the dollars, and then to maintain safely what we bought.

In the past, incidents occurring on an airfield generally passed unnoticed by most of the local people. Now that a part of the Air Force is in Mr. Smith's field, our actions are subject to closer scrutiny. Mr. Smith may wonder if we are the professionals we advertise to be. The screaming sirens of onrushing fire trucks, ambulances, and combat defense vehicles cannot help but alarm folks like Mr. Smith. The billowing black smoke they see or the explosion they hear could make them wonder about us and our capabilities.

We don't want Mr. Smith to think that we get tired of wiping up oil around the LOX lines; nor do we want him to think that we wait for a leak to get real bad before we fix it or change the impregnated gasket. He thinks we maintain what he bought for us in a professional manner and do not use short-cuts or unauthorized procedures. He expects to see the same white clad crews drive by and on the same schedule. It would be hard to explain to him that one of the crews that used to drive out to his field to go to work had an accident in the silo. We couldn't tell him that because we were nonprofessional in our safety approach, one of the crew members was critically injured and we had to replace the crew. He just wouldn't understand.

When you get right down to it would we? ☆

Major Curtis N. Mozley,
Directorate of Aerospace Safety



A QUESTION OF TIME

Lt Col John A. Anderson
Directorate of Aerospace Safety

Is time the only factor to be considered in the question of whether or not you can hold your breath in an atmosphere of inert gas, such as nitrogen?

While you ponder the answer to this question, let's assume a theoretical situation, just to impose a little urgency and complexity. This situation is not really so farfetched. It could happen to you. So, here we go.

You and your buddy (for the sake of a better name, we'll call him George) have been given the task of cleaning and decontaminating a welded seam inside a LOX storage tank. The tank has been nitrogen purged. Both of you have done similar jobs before and know exactly what to do. George will enter the manhole at the top of the tank, descend a 45-foot ladder to the bottom, and accomplish the cleaning task. You will assist him and handle the life line.

George observes that the manhole is a little too small for him to squeeze through with his bulky air pack, so he evolves a simple plan and briefs you on it. He'll remove his air pack, take a deep breath and hold it, then descend the ladder through the manhole. You'll hand him his breathing apparatus and he'll put his mask on. No sweat, the whole operation shouldn't take more than a minute or so and anyone can hold his breath that long.

Once inside the tank, however, something goes wrong! While you're handing George his air pack, he either slips or falls from the ladder. Unconscious, he dangles some 10 or 15 feet below the manhole opening. You excitedly recall that lack of oxygen for five or six minutes can result in death. If George is to be saved, you must promptly retrieve him.

You call out an alarm to nearby workers and hurriedly begin to hoist the lifeline. Help finally arrives and together you pull George to the top of the tank. But, as you try to pull him through the manhole, you encounter trouble trying to align his limp form with the narrow opening. After two more futile attempts, you begin to feel a little panic as you realize that at least three precious minutes have elapsed. Something must be done to get him through that manhole and quickly! Out of desperation, a possible solution presents itself. If you fill your lungs with air, hold your breath, and descend the ladder, you can perhaps manipulate his body through that narrow opening.

Now, let's go back to our original question: "Can you hold your breath for a minute or so in a gaseous-nitrogen atmosphere?" Even though you could hold your breath underwater for three minutes when you were a kid, come from a long line of indestructible heroes, and carry a lucky rabbit's foot, please don't be too hasty in your answer to this question. Because if you can and don't, then George's life is forfeited. Whereas, if you can't hold your breath and you attempt to do so, you will be needlessly committing suicide. So, before we undertake to answer this question, let's look at some of the variables which will influence the outcome:

First, how long can YOU hold your breath? Do you know precisely to the second under all possible conditions of stress? The average person, under ideal conditions, could possibly hold his breath for a minute. But, when the elements of excitement and physical exertion are imposed, the length of time is decreased. So, if you are contemplating a rescue attempt, you'd better be absolutely certain of your capability.

Second, how long will it take to perform this particular task? If you have time to "dry run" the problem, you can probably come up with a pretty close estimate. But you won't have time to "dry run," so a quick on-the-spot "guesstimate" will have to suffice. And, it had better be accurate, as we'll see in a minute.

Now, what happens if your estimate was slightly wrong and the task requires even a single second longer than your breath-holding capacity? Or if you involuntarily cough, choke, or gasp? You will inhale some nitrogen and as a result, the blood leaving the lungs will be loaded with nitrogen. Within 10 seconds, this oxygen-deficient, nitrogen-laden blood will be passing through the brain. While the brain tissue represents only two per cent of the body mass, it requires approximately 28 per cent of the total oxygen intake. Since it is sensitive to even the slightest lack of oxygen, the nitrogen-laden blood will cause swift and certain unconsciousness. Should you gasp in a breath of nitrogen, your life will be strictly in the hands of your rescurs. And, if rescue is not effected within five or six minutes, you might as well forget it, because it really won't make much difference!

An example of how quickly an involuntary intake of nitrogen can affect a man is apparent in an incident which occurred some time ago. Both men involved were fully knowledgeable and well-equipped. Prearranged signals had been agreed upon since the worker inside the tank would not always be in full view of the safety observer. Everything progressed normally until the safety observer's attention was distracted and he failed to observe and respond to a signal from the worker in the tank. Repeating the prearranged signal and again failing to get a response, the worker in the tank decided to take a deep breath, remove his air mask and shout to get his buddy's attention. He did so, but in the process involuntarily inhaled some of the nitrogen. Fortunately the safety observer's attention was no longer distracted. He noted the tank worker to be in trouble and withdrew him. Even so, in seconds he was unconscious. Fortunately, the prompt administration of oxygen revived the victim.

Because of the many variables involved, you just might be lucky enough to get by with a risky operation of this type. Maybe you even know someone who has taken such a chance and lived to tell of it. But the law of probabilities is vastly opposed to your doing so, and the incidents in our official files should be sufficient to deter even the most foolhardy. To date, three people have lost their lives and several others owe theirs only to the prompt action of rescuers.

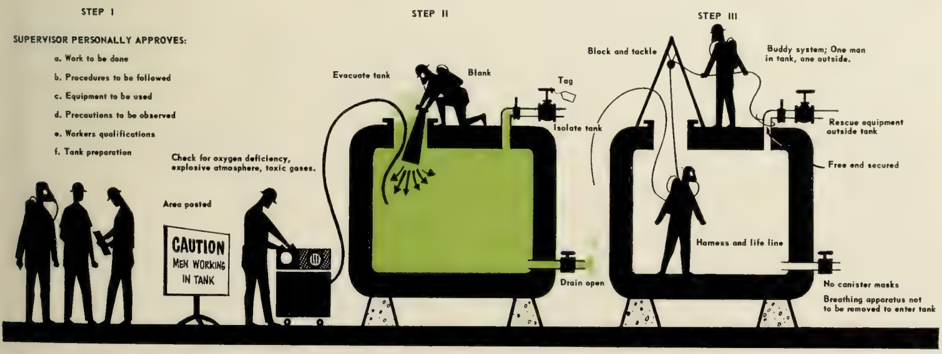
An effective accident prevention program for entering tanks and enclosed spaces requires a recognition that responsibility for safety, both at the time of entry and during the entire operation, rests with the SUPERVISOR. He must make sure that adequate steps have been taken to identify and eliminate or control the many hazards associated with the operation. Additionally, he must assure that all personnel understand the nature of hazards and the precautions to be taken. The hazards inherent in tank entry can be avoided or overcome if the following principles are applied *each* and *every* time a tank is entered:

- Establish a definite system of preplanning for tank entry and a worker instruction program.
- Prepare the tank for entry by physically isolating it, cleaning it to remove harmful contaminants, and testing it to insure absence of such contaminants.
- Protective clothing and respiratory equipment should not be used *as a substitute* for cleanliness and ventilation.
- Use a formal permit system requiring written authorization for entry only after the supervisor in charge is satisfied personally with tank preparation, precautions to be taken, personal protective equipment to be used, and specific procedures to be followed.

You've heard the expression, "the best laid plans of mice and men. . . ." Yep, it applies here, too. Just in case something goes wrong, you must be prepared to promptly rescue the worker. He should be equipped with respiratory equipment, body harness, and a lifeline. The size, shape, and location of the entryway must be considered in selecting the proper equipment. In some cases, it may be desirable to have a block and tackle positioned on a tripod or otherwise fastened above the manhole. For obvious reasons, the manhole should be large enough to accommodate the man and his equipment. But when the manhole is too small to accommodate the fully clothed and protected man, specific procedures must be developed in the preplanning phase and *made a part of the tank entry permit*. The outside safety observer must always keep the man in the tank in sight, or must have prearranged signals. The safety observer must never be distracted from his "life guard" duties. He must never enter the tank until he is relieved of his post, and then only if he is properly equipped for tank entry and assured that outside assistance is adequate.

Proper supervision, careful preplanning and preparation to cope with a mishap, should it occur, will go a long way in guaranteeing that you are never faced with the dilemma described at the beginning of this article. ☆

ENTERING TANKS OR ENCLOSED SPACES


STEP I
SUPERVISOR PERSONALLY APPROVES:
a. Work to be done
b. Procedures to be followed
c. Equipment to be used
d. Precautions to be observed
e. Workers qualifications
f. Tank preparation
Check for oxygen deficiency, explosive atmosphere, toxic gases.
Area posted
CAUTION
MEN WORKING
IN TANK
STEP II
Evacuate tank
Blank
Tag
Isolate tank
Drain open
STEP III
Block and tackle
Buddy system; One man in tank, one outside.
Rescue equipment outside tank
Free end secured
Harness and life line
No canister masks
Breathing apparatus not to be removed to enter tank

moment of truth

USAF Tactical Missile School, Orlando AFB, Fla

It's Christmas Eve and dismally grey instead of white. Dusk is beginning to settle, accompanied by a drizzling rain that has persisted throughout most of the day. Inside of the cab of the pick-up truck, it was comforting to hear the commanding drone of the engine and the snappy clicking of the windshield wipers. The brakes were grabbing though, as they always did when it was soaking wet outside. I thought I was playing it safe by keeping the speed at 45 instead of going the maximum on this slippery country road.

I saw the bent arrow of the left turn warning sign just before I saw the turn itself and thought that it was another lazy turn I could maneuver without interrupting my moderate cruising speed. Then immediately I was in the turn. It was a sharp, flat one and I had to slow down. When I hit the brakes, the right front brake locked and the pick-up spun around violently.

The centrifugal force of the swerving skid hurled me from behind the steering wheel and slammed me up against the right door. I grabbed for the steering wheel and held on. This caused the front wheels to turn farther away from the skid. The truck hit the shoulder of the road broadside and the roll-over began.

I held my grip on the steering wheel throughout the first rollover and just as the wheels hit upright the first time, the right door flew open and my hold was snapped loose. As the second sickening turnover began, I went out the open door underneath two tons of crushing, pitching metal. The truck continued its roll, leaving me behind mashed on the ground.

During all of this violent action I never lost consciousness for an instant. A searing pain in my back and a growing numbness in my legs brought on the realization that mine was a very serious injury.

If I had been wearing a seat belt, I wouldn't have been forced from behind the steering wheel and probably could have controlled the pick-up in the skid. Even if I could not have done this, a seat belt would have kept me from being thrown out during the rollover and I wouldn't be lying here now paralyzed from the waist down. ☆

This Cluttered Scope

CWO-3 Jae P. Rogers
AFSC, Scott AFB, Ill

"Don't tell me, Dad! I know what I'm doing. This is my home base and that GCA crew is hot. Just last week GCA landed me with only 100 feet and a quarter mile. Snow or no snow, I'm putting this bird in the nest."

The fact is, 100 feet and a quarter mile with no precipitation is duck soup compared to as much as 500 and one, in heavy rain or snow.

You probably wouldn't have a mile in heavy rain or snow, but the radar doesn't know that.

Are the chips down? Must you land at a particular base at a particular time? Especially when there is heavy precipitation?

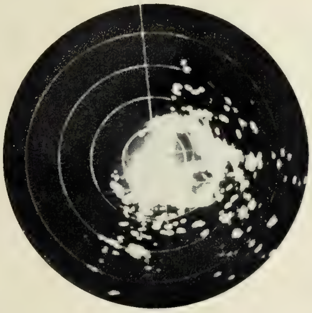
At a time and place (Berlin, 1949) it was necessary to land aircraft through heavy precipitation. These were big C-54 aircraft, but heavy rain blended with their big radar targets. They were timed through part of the landing pattern and successfully completed the flights.

The files are full of successful landings under adverse conditions. Many crews have stated GCA saved them. But let's be fair to the radar gear.

Thunderstorms affect radar scopes by partially obscuring and, in some instances, completely obliterating all aircraft targets thereby nullifying any possibility of radar assistance. This occlusion (snow on the scope) problem is further aggravated by weak, intermittent definition of small jet fighter targets on all surveillance radar scopes.

When viewed head-on, a typical jet fighter or trainer offers two to three square feet of reflectable surface to the ground radar antenna. As a result, this type of bird just doesn't paint as well on the radar scope as larger conventional aircraft with their "fans" turning.

When small jet aircraft penetrate in severe weather situations, the most proficient GCA controller in the world would be rendered helpless attempting to control the aircraft because he cannot pick up the aircraft, make proper identification and maintain positive radar contact throughout the entire approach.



In an effort to successfully combat these problems, electronic engineers have incorporated many innovations designed to eliminate undesirable ground clutter, reduce precipitation interference and at the same time improve discernibleness of aircraft targets. The following improvements are integral parts of all mobile GCA and RAPCON radar equipment systems:

Moving Target Indicator (MTI)
Fast Time Constant (FTC)
Sensitivity Time Control (STC)
Off-Centering
Circular Polarization (CP)

MTI cancels out undesirable terrain clutter which enables the GCA controller to give more accurate ASR (surveillance) approaches. In addition, MTI removes light to moderate precipitation echoes from radar scopes.

FTC is effective in breaking up large concentrations of ground returns. This aids the controller in picking up aircraft targets moving through heavy ground clutter areas. This feature is primarily used when the MTI is inoperative or not appropriate. FTC is also effective in "breaking up" the return from rain to a greater degree than it does the return from the aircraft.

STC permits maximum return from distant targets simultaneously with minimum return necessary to "see" close-in targets. Without STC multiple approaches would be virtually impossible.

Off-centering allows the traffic director to move the radar presentation to any desired position on the scope, which immeasurably aids him in concentrating on heavy traffic areas and observing movement of weather phenomena to a maximum of range in the selected quadrant.

Circular polarization considerably reduces the "Snow on the Scope" effect during periods of moderate to fairly heavy thunderstorm activity. It permits only unsymmetrical objects, such as aircraft, to be displayed on the radar scope and rejects comparatively smooth, teardrop returns such as rain. However, very heavy, extreme thunderstorm conditions containing rain or wet snow will persist in making the radar scope uninterpretable.

It remains a cold, hard fact that even with all of these "gimmicks" and "gizmos" to combat the ever present threat of weather elements—radar, as radio—is highly susceptible to interference caused by extreme thunderstorm activity. For this reason pilots should exercise caution when planning flights into areas experiencing heavy precipitation and/or wet snow and should give every consideration to the problem the GCA controller has under these adverse conditions.

In this jet age, each and every pilot should know something about the ground environment which aids him in the performance of his flight mission.

Every pilot can well afford to spend time to possibly save his neck, by visiting the RAPCONs and GCAs.

Look for yourself and look out for yourself!! ☆

Aerobits

NEAR-MISS OHRs. While the following applies specifically to SAC crews, others who may occasionally operate in the lower airspace regions should be interested.

A B-52 was on an IFR clearance, 8000 feet on an Oil Burner low level route when the pilots spotted an air carrier aircraft at the same estimated altitude and less than three miles away at the 0130 position. A climbing right turn was made immediately at military thrust. Less than 30 seconds later the other aircraft emerged from beneath the bomber's nose at the 1130 position. Vertical distance was estimated to be less than 500 feet. It was later determined that the other aircraft was operated by an air carrier on a VFR flight plan and letting down for a landing at a nearby municipal airport.

Another B-52 crew had a similar experience with a light single engine private plane. Distance this time was approximately 300 feet vertically and 500 feet horizontally. A check with FAA revealed that the light plane had not filed a flight plan and was apparently on a local VFR flight. Both aircraft turned as they approached each other and their pilots' vigilance may have prevented a collision.

Vigilance is the key word in both of the above cases. Without it there might have been disaster.

T-29 DOUBLE GENERATOR FAILURE. Approximatly 200 miles from destination the alternator generator system failed. The system was turned off, electrical load reduced and flight continued in VFR conditions. During GCA downwind the navigator noticed sparks coming from the accessory vent on the left engine, and the pilot noted that the left generator had failed. The pilot turned off the left generator but sparks continued from the vent. The left engine was shut down and four unsuccessful attempts made to feather the propeller with battery DC power. The tower was advised of the emergency and a straight-in landing accomplished without further incident.

The right generator had failed due to a crack in the aluminum pressure tube assembly, and the left due to internal materiel failure.

During subsequent tests investigators were able to feather both props on battery power during ground and air tests. No malfunctions were found in the feathering system. Suspected cause of failure of the left propeller to feather was given as excessive air load and depletion of battery power due to use of all lighting and radio equipment during the feathering attempts.

IF YOU DECIDE TO EJECT. If you are an aircrew member, there is a possibility that sometime you will have to decide whether to eject. The circumstances will govern your choice. Your decision may determine whether you live or die. If you decide to eject, give yourself the best break possible and do it correctly.

The explosive components of your ejection system are engineered to give you the "edge" in getting out and down in one piece. After you initiate them, they will take over and do the job for you, but

you must initiate them at sufficient altitude and suitable airspeed and attitude. The December-January Flying Safety Officer's Study Kit contained a copy of the USAFE publication AIRSCOOP, titled "Vector for Survival," which is the most complete work we've seen on this subject. We strongly recommend that everyone who flies in an ejection seat equipped aircraft study this pamphlet.

Another factor you should be concerned with is the mechanics of the ejection sequence. The best system cannot help you if it isn't used correctly. Each aircrew member should be trained and tested in escape procedures to the extent that, regardless of the circumstances, he instinctively follows the proper procedures for the aircraft he is flying.

To digress a bit, I know a man who frequently travels by bus, and each time he goes aboard he immediately locates all the emergency escape routes. I asked him why he was so concerned, and he replied, "If we have an accident I don't want to have to *hunt* for a way out. I'll be busy enough just getting out." Makes sense, doesn't it?

To go back to our major theme, crewmembers, practice your ejection sequence by the numbers. The simple systems will require only three actions: 1, assume the ejection position; 2, raise the grips and fire the canopy; and 3, release the grips, grasp the triggers, and fire the seat. Simple, isn't it? Yet we experienced an accident recently where the pilot never fired the seat. He lives, but it was because he was thrown out by centrifugal force at a high enough altitude to allow him to survive. He thought he had fired the seat, but it was found in the wreckage of the cockpit!

We believe that a crewmember should concentrate on flying the aircraft and performing his mission until he has decided he should eject. Then, by all means, he should concentrate on getting out alive.

If you decide to eject, and conditions permit, pick the best altitude, speed, and aircraft attitude, then concentrate on the mechanical actions required to safely get you out.

George W. Williford, OOAMA, Hill AFB, Utah

(AEROSPACE SAFETY endorses this advice and suggests that, as a backup, crewmembers concentrate on the "follow through" of the ejection sequence. That is, mechanically going through the procedure of manually releasing the lap belt, pushing clear of the seat and pulling the parachute "T" handle. This insures early detection of possible equipment malfunction, and precludes holding onto seat actuating controls. Many aircraft ejection seats still do not have seat-man separators.)

BARBED WIRE—AIRCREW ENEMY. A little over a year ago, during a safety survey of a major air command, the facilities member of the survey team recommended that barbed wire fences adjacent to the end of runway overruns be replaced with frangible fencing.

In the reply to this portion of the survey report, it was stated that the deficiencies noted were not programmed; however, these deficiencies would be considered by the Facility Programs Panel for the next fiscal year.

But about 12 months later, before action was taken, two pilots were practicing touch and go landings in a T-33 at the auxiliary field belonging to the base named in the foregoing report. After becoming airborne on the third touch and go, airspeed 120-125 knots and prior to raising the gear, with approximately 1500 feet of runway remaining, an apparent loss of thrust occurred and the pilots attempted to engage the barrier. The aircraft flew over the barrier, broke a support pole and knocked the webbing to the ground without disturbing the cable. After rolling, ballooning, and shearing the gear and speed brakes, the aircraft slid on its belly 265 feet through a six foot barbed wire fence. One strand of barbed wire was pulled across the top of the nose section, windscreen, canopy, and rear fuselage, eventually wrapping itself around the vertical stabilizer. Fortunately, there were no injuries or damage other than to the aircraft, barrier and barbed wire fence. The report stated: "When the aircraft ripped through the barbed wire fence, the top strand of wire

Aerobits

slid up over the windscreen and gouged nearly the entire length of canopy. If the canopy had been jettisoned prior to this time, the pilot most certainly would have received serious, or possibly, fatal injuries."

In this case the Air Force lucked out. As a result, there was no "blood on the paper" to help eradicate barbed wire from the end of runways. Let's keep it that way. If you see this killer at the end of a runway—see your Flight Safety Officer or take some other positive action to get rid of it.

Lt Col Clifford P. Patton
Directorate of Aerospace Safety

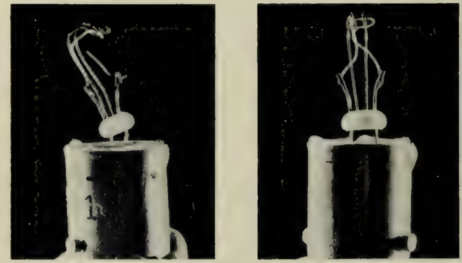
LET THERE BE LIGHT. As aircraft have become more and more complex, designers have included more and more lights in the cockpit to indicate systems operation or non-operation and various warning and emergency conditions. In modern fighters such as the century series, in addition to the usual array of lights on the instrument panel, there is a warning or "Peek and Panic" panel which monitors most of the systems in the aircraft. This panel consists of over 20 lights, each labeled so that when the light is illuminated the condition it indicates can be read directly from the face of the cover.

A moot question in any accident investigation is always which systems were operating at impact and/or which lights were illuminated when the pilot ejected if such were the case. In the past we've had to rely on the pilot's memory, always a tenuous procedure because of the stress of the moment, or physical evidence of component function at impact. In many instances such evidence is not always available, as in the case of electronic systems having no moving parts, or the evidence may be disguised by other indications.

In an article published in the December 1962 issue of the Canadian Aeronautics and Space Journal, Mr. F. H. Smith of Royal Aircraft Establishment, Farnborough, describes a procedure for analyzing the filaments of small type lightbulbs in order to ascertain which lights were burning. In general, the light bulbs used on aircraft warning systems utilize tightly wound tungsten filaments. When these filaments are shock loaded, such as at ground impact in an aircraft accident, the pattern of deformation of a heated filament is quite different from that of a cold filament (see pictures). In the case of the heated filament, the tungsten wire stretches and the windings separate. In the case of the cold filament, the break is clean and the windings do not separate. These indications have been used as an aid in accident investigations by the Royal Aircraft Establishment for a considerable length of time. In addition, laboratory tests conducted by Republic Aviation have proved the reliability and validity of the procedure, providing post impact heat damage is not a factor.

Once the validity of this approach is accepted, the determination of systems operation and/or emergency conditions can, in many instances, be made at the scene with great accuracy. Using light bulb analysis as a pointer, the accident investigator will then be in a position to make more detailed and accurate assessments of other physical evidence which might otherwise be overlooked. ☆

Lt Col Donald G. Page
Directorate of Aerospace Safety



Left, typical case of a small filament shocked in the heated state. Right, small filament shocked in cold state.

WELL DONE

1st LT WAYNE L. GOSNELL

354 TACTICAL FIGHTER WING, MYRTLE BEACH AFB, S. C.

First Lieutenant Wayne L. Gosnell demonstrated exceptional skill during an inflight emergency while participating in Swift Strike III. During a formation takeoff on an air-to-ground mission, Lieutenant Gosnell, flying in Nr 2 position, fell slightly behind lead. As he retracted his flaps at 150 feet and 200 knots, he felt his aircraft decelerate rapidly and start sinking. He quickly placed the throttle inboard, checked the pressure ratio and found it low. Noting the RPM drop rapidly through 75 per cent, he immediately hit the airstart switch, selected the emergency fuel system and jettisoned his two external tanks. He felt a surge in power and the RPM climbed to full military. Lieutenant Gosnell then pulled up onto a high downwind, declared an emergency and landed without further incident.

The power loss was caused by a break in the PB-4 line between the P&D valve and the main fuel control. Such a break will cause engine RPM to drop to 32-40 per cent regardless of throttle position. In flight, however, this could cause a flameout by rapidly leaning the fuel-air ratio in the combustion chambers. Although caught in a situation most conducive to panic, Lieutenant Gosnell's immediate, deliberate and precise reaction to an emergency in a most critical phase of flight saved the Air Force a valuable combat aircraft and certainly merits the USAF Well Done Award. ☆

A TALE OF TWO ALTIMETERS

'Twas early in the letdown, the descent check complete
A call came from the scanner, made me shudder head to feet.
"Saw a mountain thru the clouds, sir, at our 3 o'clock position!
If we'd descended more to right, there'd sure been a collision."
We checked the entire panel, feeling something was amiss
For the dope we'd got from RAPCON shouldn't cause a fright like this.
What was that setting, Harry, the controller passed to us?
Could a wrong set up altimeter be causing all this fuss?
No, the setting that we used, Tom, is the one we just received.
We missed the mountain, partner, for that I'm much relieved.
But wait a minute, Harry, the dial took quite a spin
One thousand feet or better marked the change that we cranked in.
Look at the forecast altimeter on our 175
By golly, see that entry, it's a wonder we're alive.
The setting that we got, Tom, was far from being right.
There's something wrong in RAPCON or the troops have lost their sight.
Although they erred in giving us this setting, for sure
Just a little check by us would have been the safest cure.
So that's the little story of a miss good as a mile
Don't let up for a moment, we've got no cause to smile.
Use all the brains you've got, lads
Double check when you're in doubt
And you'll live to be a hundred
No problems worse than gout. ☆

Maj George H. Tully, AFCS Scott AFB, Illinois

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ZYS

AEROSPACE

SAFETY

UNITED STATES AIR FORCE

NOTHING TO PUT YOUR FINGER ON

SEE PAGE TEN

MAY 1964

WHAT IS... safe′ty? (sāf′tĭ), n. 1. C

or hazard. **2**. Quality o
danger or harm; safeness.
oneself or others safe, esp.
protective device, as on a
6. *Amer. Football.* Any a
on, above, or behind the go
his own goal, provided the
line was given by the side d
made. **7**. *Baseball.* A sa
to ensure the safety of the
Of or pertaining to the safe
ployees, or the like, from a
engineers.

What is Safety? Ask a dozen people, you'll get a dozen different answers. Some people equate it with reliability. Others see it as a distinct and specific function, i.e., the safety office, the safety officer.

Some say that Safety is accident prevention, but this is a very broad and rather vague concept. Some think of it only in terms of prevention of death and injury to people. Others include equipment in their thinking.

Perhaps a few definitions will help. Safety is a guard at the crossing where children go to school. Safety is teaching your children not to play with matches. Safety is well conceived design so that a pilot in a moment of stress will not pull the wrong handle, or trip the wrong switch.

Safety is listening closely to information or instructions so that confusion as to what is expected will not ensue. Safety is knowledge of aircraft structural and operational limitations so that they will not be exceeded. Safety is the little extra concern that assures that a cotter pin will not be omitted, that tires will be properly inflated so that one will not blow out on takeoff or landing.

Conversely Safety is NOT sending a crew off in freezing rain. Safety is NOT hiding something that may cause someone else to have an accident. Safety is NOT taking for granted what one must be absolutely sure of. Safety is NOT exceeding your own and your aircraft's limitations. Safety is NOT drinking before driving.

Safety is NOT directives, regulations, technical orders, checklists that are ignored or disregarded.

As we said, ask a dozen people the meaning of safety and you'll get a dozen different answers. If they all meant the same thing, only in different words, we wouldn't have such a problem. But Safety IS different things to different people. This can be dangerous, for example, if SAFETY to a safety officer means the hanging of posters on hangar walls, or a dull lecture to a restless captive audience at the safety meeting.

Safety can be all things to all people if it is a positive force. Actually isn't Safety something of a natural law that is ingrained in all of us from infancy on? It is reaction to hazard. It is self preservation. But is it survival of the fittest? If it is, then we had better back up and regroup. For safety must be of the concept that "I am my brother's keeper."

The mechanic following this concept takes the necessary time and care. The designer studies and restudies to make sure there will be no flaw in the placement of equipment, the strength of materials and the overall reliability of the system, even while staying within the parameters that seem to limit him.

Does not the commander who demands mission capability mean "with safety?" Without safety, in its broadest meaning, would there be any mission capability?

Perhaps after examining the word we can say that Safety is a state of mind—that it is an all encompassing word that includes all of the meanings that many minds can conceive. It is the individual performing his job to the limit of his capacity and without deviation from the principles the word Safety connotates.

This concept, believed in, acted upon and carried out by each individual will guarantee the achievement of the Air Force mission at the least cost in men, money, and material. ☆

RWH

FALLOUT

PERSONAL LOCATOR BEACONS

On page 26 of the December issue of AEROSPACE SAFETY, Major William R. Detrick mentioned that USAFE had purchased SARAH for use in their area.

It might be of interest to readers of AEROSPACE SAFETY that we here in the Pacific have found that voice transmissions on 243.0 mc by aircraft in the search area jam the SARAH receiver and greatly hinder scope interpretation. The more sensitive IT&T receivers used by NASA are effected to a lesser degree and we were able to recover one pilot in August 1963. His SARAH PLB was picked up while the aircraft was still 54 miles away and at an altitude of only 9000 feet. Other aircraft using another receiver were unable to get direction indications because of jamming.

Capt Donald L. Hagerman
Hq 5AF
APO 925, San Francisco, Calif

Air Force is slated to receive 28,000 personal locator beacons. These beacons will transmit on 243 mc. . . . more reason for everyone staying off Guard except in a bona fide emergency.

MISUSE OF GUARD

After hearing transmissions on Guard channel averaging every 50 seconds apart (only one genuine, valid call) I have finally decided to write somebody.

Is it any wonder pilots will fly around with Guard turned off?

Los Angeles ARTC maintains that an airplane on a clearance in their traffic area not in radio contact with the Center is reason enough to attempt contact on Guard. I don't think so. Neither do most of the other test pilots here at the United States Air Force Production Flight Test Facility at Palmdale.

What is your opinion?

George M. Andre
Pilot — Fighter Flying
Lockheed-California Co.

Our opinion is that **any** *non-emergency transmission on Guard is a potential hazard to flight safety. We have been, and are continuing, to explore means of minimizing such transmissions. FAA Liaison personnel here at DTIG, Facilities people, and project officers are among those involved. We suggest you continue to watch AEROSPACE SAFETY magazine for developments. Thanks for writing; if you or any other reader has suggestions, we're most interested.*

LEARNING THE HARD WAY

I had a frightening experience a few weeks ago that I should be ashamed to talk about, but considering my attitude before it happened, it might be worthwhile to mention it to you.

(continued on page 28)

AEROSPACE SAFETY

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VOLUME TWENTY NUMBER FIVE — USAF RECURRING PUBLICATION 62-1

TESTS SHOW T-BIRD PILOTS CAN PENETRATE AND LAND WITH . . .

Last July a story about a T-33 stuck on top of a cloud deck appeared in AEROSPACE SAFETY magazine. The bird's airspeed indicator was out, the fuel situation was critical and the cloud deck extended to within 500 feet of the ground. With the help of an alert team of controllers and led by the pilot of a commercial airliner, the T-Bird pilot made a safe descent and landing.

A few days after the magazine went out the editors received a call from Mr. Francis Gebby of Lockheed Aircraft Corporation who said he knew of a method of flying the T-Bird safely without the use of an airspeed indicator. He offered to come out to Norton and tell us all about it. A few days later Mr. Gebby and Mr. Wiliam Richards came to Norton to discuss the proposal. Then a trial flight was conducted at Norton and it was decided to ask the Aerospace Research Pilot School at Edwards to run some tests. It was accepted as a special project for the Stability and Control Curriculum of the Aerospace Research Pilot School. The results of those tests follow.

The flight test program was conducted with three T-33s at the Aerospace Research Pilot School, Edwards AFB, during December 1963 and consisted of six flights totaling nine hours and 30 minutes flying time.

The aircraft were flown with two 230 gallon tip tanks installed but without travel pods. The data obtained determined a flight technique that could be used to make instrument penetrations under actual IFR conditions with the airspeed indicator inoperative.

TEST RESULTS

In order to get a good cross section of opinion the tests were conducted by six pilots, Capt G. Bertelli, Italian AF; 1/Lt H. M. Van Den Biggelaar, Royal Netherlands AF; Capt A. G. Myers, III, Capt J. F. Stroface, Capt J. A. Morrison, Maj R. S. Buker, USAF. Fuel loads were between 100 gallons and 250 gallons to simulate normal fuel for arriving at destination. Three evaluations were made. The first two assumed that the airspeed indicator only was inoperative. VOR penetrations and ILS-GCA approaches were made to minimum altitudes in these two evaluations. The pilot remained under the instrument hood at all times and the airspeed indicator was covered with a piece of cardboard. The third evaluation assumed that all pressure flight instruments (airspeed, altimeter, and rate of climb) were inoperative and instrument descents were made to an altitude of 5000 feet above the ground.

The first test consisted of making a complete letdown from holding pattern to minimum altitude. The aircraft was trimmed to "hands off" flight during this test with no reference to number of trim bursts. It was found that by using a power setting of 85 per cent and trimming to hold a constant altitude of 20,000 feet the airspeed stabilized between 190-200 knots. This is the holding pattern airspeed as outlined in TO IT-33A-1 dated 1 May 1963. During turns three per cent RPM was added to maintain airspeed. The penetration was accomplished by reducing power to 65 per cent RPM, extending the speed brakes and placing the horizontal bar of the attitude indicator on the 60-degree bank index. The aircraft was trimmed to zero forces and the airspeed stabilized between 240-250 knots.

After penetration turn, as low station altitude was approached, the procedure departed from TO IT-33A-1 in that the speed brakes were left extended and RPM was advanced to 83 per cent and not changed until minimum altitude was reached. The aircraft was trimmed to hands off flight at low station altitude and the airspeed stabilized between 175-180 knots in straight and level flight. When low station was reached gear and 30-degree flaps (60 per cent) were lowered and low station altitude was maintained until interception of the ILS glide slope. The aircraft was then trimmed to full aft position. The airspeed continued to bleed off and finally stabilized between 135-140 knots throughout the approach. Forward pressure was required on the stick to maintain the ILS glide slope. The approach was continued to ILS minimum altitude where 100 per cent power was applied, gear and flaps retracted and a rate of climb of 2000 feet per minute established. The airspeed was above 200 knots and while the climb schedule was not optimum, the aircraft was in a safe flight condition.

Six VOR-ILS penetrations were performed on the Edwards AFB VOR-ILS (Figure 1) with airspeeds falling as listed above.

Radar approaches were also performed simulating an inoperative airspeed indicator. These were performed at George AFB (Figure 2).

On GCA downwind a power setting of 73 per cent RPM held the airspeed at 175-195 knots. The time spent on downwind leg was insufficient for the airspeed to stabilize. The airspeed variation was still acceptable. The gear was extended on base leg and power increased to 75 per cent RPM. The airspeed stabilized between 135-140 knots. Final approach was conducted similar to the ILS final approach with speed brakes extended, 30 degrees (60 per cent) flaps and 83 per cent RPM. This held the airspeed between 130-135 knots. Twelve successful approaches were made to GCA minimums.

Pilot skepticism at the start of the tests and fear that approaches would be "hairy" at best faded completely during the tests. All pilots were highly satisfied by the results of the tests and felt that practice approaches simulating an inoperative airspeed indicator should be introduced into the student pilot's flying curriculum and become a part of all instrument flight checks each year. The airspeed on final approach "felt" too high. This was caused by the requirement to hold forward pressure on the stick to maintain proper position on the glide slope. Actually, the airspeed was always fairly constant from 135-140 knots. Interest was expressed for trying this technique with other type aircraft.

The second method tested consisted of using the attitude indicator and altimeter and counting trim bursts from the UP edge of the green light or neutral longitudinal trim position. The test started at 20,000 feet, cruise configuration, and 80 per cent RPM. The aircraft was trimmed to the UP edge of the green light position. From this position, the trim button was actuated

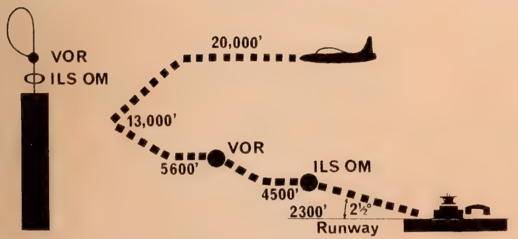


Fig 1
Edwards AFB VOR-ILS Penetration and Approach

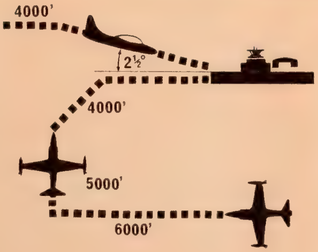
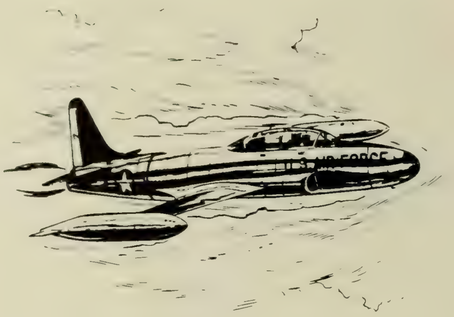


Fig 2
George AFB GCA Approach



in one-second bursts to zero stick force. This occurred after six bursts. It was noted that this was a much slower trim rate than most pilots use, so all pilots were requested to use their normal rate to trim to zero stick force. It was found that 10 normal bursts would produce the same effect as six one-second bursts. All pilots agreed very closely on the number of bursts to zero stick so that for the remainder of the tests the trim bursts were made at the normal pilot trim rate. (All future reference to trim bursts in this report will be considering normal trim rates.)

The penetration was made by reducing power to 65 per cent RPM, extending speed brakes, trimming to the green light ON and placing the horizontal bar close to the 60-degree bank index and letting the airspeed stabilize at 240-250 knots. At the completion of the penetration turn, as low station altitude was approached, the speed brakes were left extended, RPM increased to 83 per cent, and nose up trim actuated for 10 bursts. The altimeter was used to maintain level flight and the airspeed bled off to 175-180 knots. At low station gear and 30-degree (60 per cent) flaps were extended, the aircraft was trimmed to full nose up and the airspeed bled off to 140 knots. At this time the ILS glide slope was intercepted and the descent started with the airspeed fluctuating between 135 and 140 knots. The approach was terminated at ILS minimums where missed approach procedures were initiated.

Radar approaches were also accomplished using this technique. The downwind leg in the cruise configuration required 73 per cent RPM and 14 bursts to hold airspeed at 175-185 knots; base leg with gear down required 75 per cent RPM and no trim change; final approach with speed brakes extended and 30 degrees (60 per cent) flaps down required full nose up trim to hold 120 knots straight and level and 135-140 knots on the final approach glide slope.

This second method showed no advantage over the first method since the altimeter was still relied on to confirm level flight. It had the disadvantages of requiring large stick forces when trimming to the green light on condition before the actual UP operation and also having the instrument cross-check deteriorate while searching for the green light position.

The third method tested was to determine whether or not a safe descent could be made with all the pressure flight instruments inoperative. In the event the static pressure system becomes inoperative, the altimeter and rate of climb will also be inoperative. This test started under VFR conditions on top (20,000 feet) with outside reference to the horizon. The aircraft was trimmed to a constant attitude at 85 per cent RPM. The airspeed stabilized at the aforementioned 200 knots. A hooded penetration was then made by reducing the power to 65 per cent RPM, extending speed brakes and placing the horizontal bar of the attitude indicator on the 60-degree bank index. The trim was returned to the green light position and descent started. The airspeed increased to 240-250 knots and stabilized. The descent was terminated at 5000 feet above the ground simulating the VFR conditions of breaking out of an overcast. Recovery to level flight was made by retracting the speed brakes and adding power to 80 per cent RPM. The aircraft was then flown under VFR conditions using outside reference for attitude. Two successful penetrations were made using this technique.

CONCLUSIONS

1. The test results indicate that adequate control of the T-33A aircraft can be maintained with an airspeed indicator inoperative under IFR conditions.
2. The test also indicated that descents could be made from 20,000 feet to 5000 feet under instrument conditions with both the airspeed indicator and altimeter inoperative.
3. During all phases of a VOR penetration and ILS or GCA approach the deviation from optimum airspeeds can be maintained well within safe margins.
4. The technique using the attitude indicator, altimeter and zero stick forces proved better than the method of trim bursts; however, either is adequate.
5. The technique requires "blind faith" using the power settings and trim techniques outlined in this report.

RECOMMENDATIONS

1. The first method outlined in this report using the attitude indicator and altimeter be added to instrument flying as an emergency method for making an instrument approach with the airspeed indicator inoperative.
2. The third method outlined in this report be added to instrument flying for making a letdown to ceilings higher than 5000 feet above the ground with the airspeed indicator and altimeter inoperative.
3. Penetrations and low approaches with the airspeed indicator inoperative be introduced in the student pilot training program and added as a requirement to maintain instrument proficiency.
4. If these procedures are adopted, pilots use their normal trim rate to count bursts when making a letdown with no airspeed indicator.
5. Tests be conducted on other types of aircraft for evaluation as a possible emergency method for making penetrations and approaches in these aircraft. ☆

Hydroplaning...

Fun or Disaster?

Lt Col Earl F. McKenny, Directorate of Aerospace Safety

ALTHOUGH WATERSKIING OR AQUAPLANING has been widely accepted as a sport and fun pastime, tests by the Air Force and National Aeronautics and Space Administration have proven it to be a potential hazard to aircraft operation. It has been known for a long time that hydroplaning keeps water skiers on top, and now it has been learned that the same phenomenon can keep airplanes from making contact with the runways under certain conditions.

The NASA film, "Hazards of Tire Hydroplaning to Aircraft Operations" explains the phenomenon, how and why it happens, and how best to minimize the adverse effects. This film, serial number L-775, can be borrowed or purchased through the NASA Langley Research Center, Langley Station, Hampton, Va.

USAF, independent of the NASA studies, substantiated many of the same conditions concerning hydroplaning. The Air Force project was primarily devoted to determining causes of B-58 brake ineffectiveness on wet runways and stemmed from a series of incidents and accidents. Replacement of the smooth dimple tread tire by a rib tread tire was one outcome of the B-58 tests.

To go back to the NASA report, it was found that as tire hydroplaning increases, the friction coefficient decreases until, under total hydroplaning conditions, aircraft wheels stop rotating. Tests confirmed that braking degrades on slightly wet runways because of lubrication effects between tire and runway. The same tests disclosed that braking decreased in deep fluid or slush. In this context, deep means from ⅛ of an inch to ¼ of an inch, depending on runway surface. It is under these "deep" conditions that tire hydroplaning becomes a serious problem.

After much testing with models, the NASA Langley Research Center began full scale testing at its landing loads track test facility. Here they ran a completely

Hydroplaning... continued

instrumented test carriage with full scale gears and wheels to over 100 knots. Runway conditions from dry to a two-inch fluid depth were used. Slush depths of ½ to 2 inches were also investigated. These tests proved that partial hydroplaning occurred at the lower speeds, total hydroplaning could occur at the higher speeds, wheel rotation would stop completely. (Actual test run films show wheel rotation stopping in both the NASA and B-58 tests.)

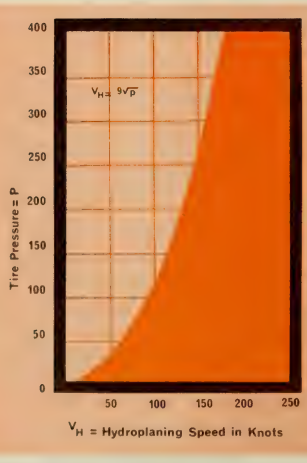
There is a fairly simplified explanation of the physical principles involved in wheel stoppage in total hydroplaning. Figure 1 shows a standing tire, with the only acting force the ground reaction caused by the weight or vertical load on the tire. On the rolling tire (Figure 2) the situation is becoming more complex as ground friction, tire deformation, and tire hysteresis enter the picture. When the tire is rolling freely at a fixed forward speed on a dry runway, a rolling resistance force acts on it in a direction opposite to the motion of the aircraft. This produces a moment on the tire in the accelerating or spin-up direction. This reaction must be opposed by an equal spin down moment which is produced by a shift of the vertical ground reaction ahead of the wheel axle centerline. In Figure 3 a deep fluid on the runway further complicates the picture. Additional drag on the tire is produced when the fluid is displaced from the tire path. Also, as the forward speed is increased (Figure 4) the spray pattern thrown up by the tire changes and the wedge of fluid penetrates the tire ground contact area producing a hydrodynamic lift force on the tire (a partial hydroplaning condition). As the forward speed continues to increase the spray pattern becomes flatter and the wedge of fluid penetrates farther into the ground contact area resulting in increased hydrodynamic lift on the tire. At some high forward speed (Figure 5) the hydrodynamic lift force becomes equal to the vertical load being supported by the tire. It is at this point that complete separation between the tire and the ground takes place and total hydroplaning occurs. Rotation stops under this condition because ground friction causing spin-up has been reduced and the predominating spin-down moment tends to stop wheel rotation. As the speed increases above total hydroplaning speed, there is further reduction in fluid drag forces as the tire rises up out of the fluid and rides along on the fluid surface.

As the hydroplaning tendency increases, aircraft directional control and braking effectiveness decrease.

In the NASA film the footprint area of a tire is shown during progressively faster runs. The wedge of fluid can be seen progressing farther into the ground contact area until, at total hydroplaning speed, there is no tire ground contact area showing. On an FAA artificial slush bed test with a Convair 880, when the aircraft entered the slush bed at 120 knots, with a crosswind of 9 knots, a yaw was induced that could not be corrected

POSSIBLE TIRE TOTAL HYDROPLANING SPEEDS

(Tire pressures based on representative takeoff gross weight servicing.)



Type Aircraft	Gross Weight	Nose Gear	Main Gear
T-33		80psi:80K	155psi:112K
T-39		75psi:78K	165psi:116K
F-100	40,000	185psi:122K	280psi:150K
F-104	24,000	199psi:128K	247psi:141K
F-105	52,000	140psi:107K	200psi:128K
F-106	40,000	140psi:107K	285psi:151K
F-4	50,000	150psi:110K	375psi:175K
KC-97	170,000	77psi:79K	182psi:121K
C-118	107,000	70psi:75K	105psi:92K
C-123	54,000	45psi:60K	65psi:73K
C-130	120,000	60psi:70K	79psi:80K
KC-135	280,000	130psi:103K	144psi:108K
B-47	180,000	180psi:121K	180psi:121K
B-52	400,000	202psi:128K	228psi:136K
B-57	55,000	146psi:109K	146psi:109K
B-58	160,000	160psi:114K	270psi:148K
U-3		30psi:49K	40psi:57K

by the pilot until exit from the slush bed. A definite loss of braking was also noticed during these tests.

Analysis of test results indicated, surprisingly, that changing the weight carried by the tires appeared to have little effect on the speed at which total hydroplaning occurred. As the weight on the tire changed, the footprint area changed but the ratio of weight-to-area remained constant. This ratio is essentially the tires' inflated pressure. The two major factors in tire hydroplaning were found to be the forward speed and the tire inflation pressure. During controlled tests with conditions of vertical loads and fluid depths remaining constant, it was found that hydroplaning occurred on a tire with a pressure of 25 pounds per square inch at about 45 knots, 50 pounds/square inch at about 63 knots, and 75 pounds/square inch at about 77 knots. This all led to development of a fairly simple formula based on classical hydrodynamic lift theory to quite accurately predict the total hydroplaning speeds. It is $V_H = 9\sqrt{p}$ where V_H=tire hydroplaning speed in knots and p= tire inflation pressure in pounds per square inch. The equation proved valid for smooth tires or for grooved ires where fluid depth exceeds tread groove depth.

Here are some practical applications. The average automobile will be susceptible to total hydroplaning it about 50 mph. The typical propeller-driven transport could encounter this condition at about 72 knots, the jet ransport at about 100 knots and the jet bomber and cenury series aircraft at about 150 knots. These speeds are vell within the normal takeoff and landing speed ranges or the respective aircraft. On page six is a list of several JSAF aircraft and their tire hydroplaning speeds.

Tests have revealed that several factors affect the he hydroplaning speed of a tire. All factors, such as ire inflation pressure, runway fluid depth, runway surace character and tire tread pattern are variables that nfluence actual total hydroplaning speed. It should be emembered that partial hydroplaning can mean trouble ind it occurs to varying degrees at speeds below that or total hydroplaning.

The adverse effects of tire hydroplaning can be minimized if certain facts are kept in mind.

- Crosswind takeoffs and landings on wet or flooded unways should be avoided.
- When landings on very wet runways must be nade, use such techniques as minimum safe touchdown peed, early runway contact, early use of spoilers, wheel rakes or reverse thrust. (Use caution on use of wheel rakes or reverse thrust as directional control may beome a problem.)
- Smooth or worn tires may tend to hydroplane with esser fluid depths—with as little as 1/10 inch of water resent. Ribbed tread tires may hydroplane in 2/10 to /10 inches of water. ☆

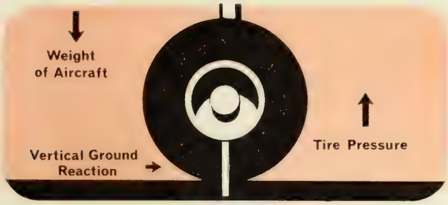


Fig. 1: Standing tire

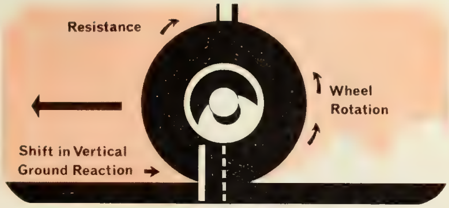


Fig. 2: Rolling tire, dry pavement

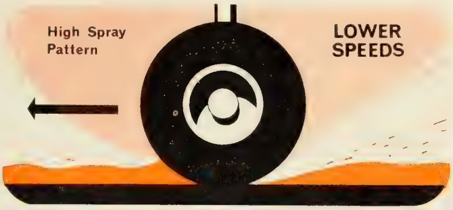


Fig. 3: Tire contact with deep fluid

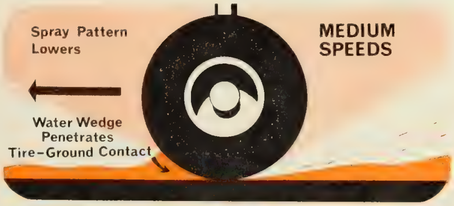


Fig. 4: Partial hydroplaning

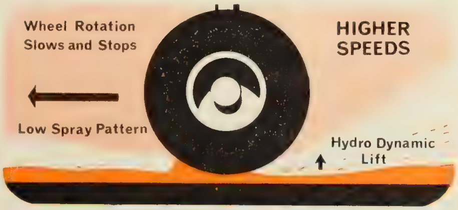


Fig. 5: Total hydroplaning

Lt Col Don H. L. Anderson, 4th Weather Wing, Scott AFB, Ill

FAIR
TODAY'S FORECAST
~~FOUL~~
WHY YOUR WEATHERMAN CRIES A LOT
INK

How do you use your Weatherman?

"Never mind the lecture, Charlie, just sign the clearance—I'm in a hurry."

"But sir," replied Lt Charles, "there is a very active squall line crossing your flight path, your destination is questionable because of high, gusty surface winds, and the alternate you have indicated does not meet the requirements of 60-16!"

"Don't hand me that stuff, Charlie," said Captain Stallout, "I've got a good aircraft out there. I'll be over the top of your squall line and gusty winds won't bother me. If you insist I'll change the alternate."

The above conversation took place at Roughramp Air Force Base on a beautiful Friday afternoon in early spring. Captain Stallout was ready to take off on a ferry flight to deliver an airplane to a unit at Ellington AFB. It had taken him six full weeks to get this trip set up, numerous sessions with the Squadron Operations Officer, approximately $19.00 in long distance phone calls to "the sweetest thing in Houston," and now he was ready to go. His reservations were waiting at the Shamrock Hilton, and he was in no mood to listen to a lieutenant weather type who obviously was a confirmed pessimist and over-impressed with his duty title. Why this youngster had just graduated from school and was on his first assignment in Uncle Sammy's Air Force. How could he possibly appreciate the flying proficiency of the most senior captain in the squadron?

Lt Charles, fairly newly commissioned and a recently certified weather officer had graduated the preceding June from Texas A&M, having successfully completed the basic study course in meteorology. He looked around for his boss, Major Thermal, then remembered he was briefing the flying safety meeting on springtime flying conditions in the Southeastern U.S. "Boy, I wish this guy was attending that lecture," he said to himself.

"Well, Captain, just let me explain what is happening," Charles said, pointing to a surface weather chart.

"Now look, Lieutenant," snarled Stallout, "I can see the map and have probably looked at more weather maps in my career than you have. Just make some marks on the clearance and sign it. Nothing, but nothing, is going to keep me from making this flight—on schedule!"

"Yes, sir, Captain," said Charles, and made the necessary notations in Section D and signed the form. Stallout grabbed the clearance, signed it off, threw a copy in the general direction of the dispatch counter and tore out to his bird. He shattered all existing quick start records and was taxiing out to the active runway before the tower and Flight Control were aware of his proposed flight.

Some delay was experienced awaiting clearance, and it was because of the considerably diminished fuel load that he was able to get off the runway in a distance much shorter than computed. Climbout was uneventful. Everything was trimmed up, and Stallout was contemplating the vision a couple of hours hence at the Shamrock pool when he suddenly realized that he was not near high enough to transcend the wall of clouds ahead. Adding power, he began climbing and searching for a saddle.

Meanwhile, back at the Roughramp Weather Station, Lt Charles was reviewing the weather situation. A cold front had come booming out of the Great Plains the night before and was moving rapidly eastward. It extended from a deep low pressure cell in the vicinity of Sioux City southward into Mexico near Laredo. Along with this, a strong southeasterly flow for the past week had blanketed the entire area covered by Captain Stallout's flight path with warm, moist, unstable air. Temperature across the front was averaging about 40 degrees. The front itself was moving about 35 knots and was just now approaching the Houston area. Ahead of the front an intense squall line was now showing up at 350 miles range on the weather radar scope at Roughramp. The fact that it showed up at that distance confirmed previous radar reports that tops extended to above 65,000 feet. Although no hail had been reported by ground stations, it would be a good assumption that heavy hail would exist in some storm cells above 10,000 feet. Turbulence would also be a factor to be considered. Judging from pilot reports when the squall line was only partially developed, there should be severe with occasional areas of extreme turbulence in the squall lines.

"Well Lieutenant," said Charles, musing to himself, "there will probably be saddles between the main thunderstorm cells which won't run above 20,000 to 25,000 feet. The captain can probably maintain VFR on top by going through these saddles. I guess he'll be able to maintain clearance at 35,000 feet; however, I wonder if he'll encounter hail and turbulence in the clear air. Guess I should have insisted on briefing him. Should have said something about the winds too."

The southern jet stream was most intense just 75 to 100 miles north of Stallout's course. He should experience a 50 knot headwind for the first third of his route, and an average of 70 knots for the balance. Max winds would be about 90 knots.

At 35,000 feet, and 300 miles west, Captain Stallout, after 25 minutes of searching, found a saddle between two large anvils. As he began to penetrate, he said to himself, "That meterological neophyte back at old Roughramp air patch sure has a thing or two to learn about weather. He was trying to scare me. Smooth as glass and on top of—whoops, little rough in here. Man those are big, big build ups, they must go up to. . . ." Ping-rattle-woosh! "Hey, that's hail! What the devil, I'm in clear air! Oh-oh, the right engine doesn't sound right—like it wasn't made to be an ice crusher. Best shut her down. Zing! What the devil was that? How come it's so quiet all of a sudden? Oh-oh! Radio's gone. Now how am I supposed to get some help? Well, things ain't so bad. Ellington should be straight ahead, just beyond the next line of build ups. That must be that front the youngster was babbling about. Well, it doesn't look near as bad as what I've been through. I'll just use radio failure procedures and have her on the ground in short order. Yessir, got it made, and I'm right on schedule, even young Windy couldn't slow me up. Windy! Yessir, I'll have to remember that and christen him with a nickname when I get back. Come to think of it, didn't he say something about winds at Ellington? Can't ask anyone with no radios; guess I'd better see what he put on the clearance. Gad! I hope he was kidding! 320 at 30 knots with gusts to 45! Why didn't that clown tell me that was 30 degrees off the runway direction? Can't go back to my alternate, cause I'd have to cross that squall line again. Well, Hotrock, put her down. Aren't you the senior captain in the squadron? Sure you can do it. No sweat. Not too slow now, easy does it. Wheels down, in the green, just a bit of flaps and touch down just over the threshold lights. Steady now. Kill that drift. That's it. Now! Perfect, right on the money. Using up more runway than I thought with this wind. Oh no!"

Captain Stallout spent the rest of the day and most of the evening in discussions with the Base Commander, Operations, Maintenance and Flying Safety types. At midnight the desk clerk at the Shamrock Hilton cancelled the reservations wondering what happened to the joker that sent two telegrams and a registered letter for the reservations.

Two weeks later, the findings of the Aircraft Accident Investigation Board read, in part:

"Primary cause of the accident was the failure of the operator to properly plan his flight and to take into account weather information available to him prior to departure.

"A contributing cause was the failure of the weather officer to properly brief the pilot in accordance with Air Weather Service Regulation 55-23."

Lieutenant Charles in his testimony stated:

"My forecast was fully compatible
With the squall line and front, bilateral.
I made not a sound, kept my head in the ground,
What day does the board meet, collateral?"

Captain Stallout, when queried as to his opinion as to the findings of the board stated:

"My pilot technique though phenomenal,
Was not up to the weather, abominable.
Flight planning I skipped, the airframe I ripped,
And now I have pains, abdominal." ☆

The daughter of the maintenance technician had a cold. Her parents didn't get much sleep. Her father decided to fix his own breakfast; his wife was sleeping so soundly at 0530. He had to hunt things; finally settled for coffee, cold cereal and toast, and left the house late.

The mission was scheduled for an 0800 takeoff. He hurried his preflight.

The armament technician was on time, but had to stand around until the maintenance technician finished. He frequently rubbed his hands and stomped his feet. When he saw the coffee wagon pull in by the shops he went over. Later, he saw the maintenance technician having coffee on the other side of the wagon and asked if he were through on the plane. He was.

Fire control circuitry checked. He flipped the checklist, but performed most of the items from memory, being a little pressed for time. He had to be finished by 0730.

Lt Morgan couldn't believe it at first. He had a leak in his oxygen mask. The PE guy was out for coffee. Got to make a decision. The leak didn't seem too bad. The cockpit was pressurized. Besides, it's not often that pressurization fails. Just saw a film though—a pilot's got about seven seconds in sudden decompression to 45,000.

At briefing yesterday the Old Man had congratulated everyone—hadn't been a mission delay all month. Hate to be the first. "Nuts," Morgan said to himself. "Take it."

The armament tech held up a circled right thumb and forefinger when he saw the pilot and the maintenance tech approaching. He got out of the cockpit, ducked under the wing of 326 and began looking for 337. Had to check it next. He looked at his watch, and moved faster.

One of those days; everyone just a little behind.

The officer in Mobile Control checked his watch—0757. Again he looked at the three fighters in run-

NOTHING To PUT YOU

up. He punched his mike button. "Blue Leader, you say Blue Four is coming out?"

"Rog . . . Blue Four, how ya' doin'?"

"Blue Lead, Blue Four, on my way."

The fourth fighter, 326, took the turn from the ramp to the taxiway. Even in Mobile Control the sound of the jet blast was noticeable as the pilot poured on catch-up power.

Time 0759. Blue Lead released his brakes and, followed by his wing man, rolled onto the active.

INGER ON

An armament man ran to the side of Blue Four, worked rapidly on the right pylon, ran around to the left side, ducked under the wing, then raced away.

"Ready, Blue Four?"

The edge of the metal visor on the white hard hat in the cockpit of Blue Four glinted in the sun as Lt Morgan turned to see that armament was clear.

"Blue Four, Roger."

"Line up . . . Tower, Blue Lead, rolling."

"Roger, Blue Lead, wind zero three zero, eight knots. Cleared for takeoff."

No delay!

The mission was routine. Blue Four's missile hung fire, but that happened now and then. All that was required was a routine report and a systems checkout. A solenoid was found to be sticking. Could have had some bearing, but probably not. Besides, things like that can crop up anytime. Records check showed no discrepancies on the preflight. The solenoid was changed.

Lt Morgan left his mask with the PE man. It would be repaired or replaced by the next mission.

The maintenance tech pulled a routine post flight on 326. Nothing . . . oh, he found a plugged drain hole in the right wing. He cleaned it, using a piece of wire. A little stream of water ran out. He could take a panel off, but, no sweat. It would dry out before the next day's mission. He looked at his watch—1020. He'd better call and see how the baby was getting along. His wife would surely be up by now.

He went over to the line shack to make the call.

"Hi, Bill, how's it going?" One of the fellows who had been on two weeks leave asked the question.

He waved. "Nothin' doin', strictly routine," he replied.

"Heard your bird had a missile fail to launch."

"Yeah, happens every now and then. They'll get 'em perfected someday."

"Let's go for coffee."

"Can't, baby's got the bug, hafta call my wife."

Over in squadron operations the scheduling officer put black check marks after all the morning missions. The Board really looked good this month.

In the training section the training officer took a black grease pencil and drew a neat X in a square on the line with the name, LT MORGAN.

At 0120, Lt Rohr aborted with 374, two minutes after the backup had been called out of commission for a tire change.

Quickly—what's available? How about 326? Where's . . . oh, that's right—he left to take his daughter to the dispensary. How about the 781?

Take 326!

The switch was made in minutes. Armament hung the rockets in record time.

Close, but they made it. On time!

The afternoon report on 326 was a lot more complicated than a 781 entry and two squares filled. It was eventually made on a 711. It required two weeks and the full time effort of an accident board. Their only real clue was the statement of the pilot. Upon entering the range, and shortly after arming, the bird had pitched up and rolled hard right. Nothing Rohr had tried was effective. He'd called Lead and had tried everything Lead had suggested. And, at 10,000, following Lead's order, he had punched out.

There wasn't enough left of 326 to give the investigators a clue. They'd called in an electronics expert from the Directorate of Safety and skilled company investigators had come down. Nothing.

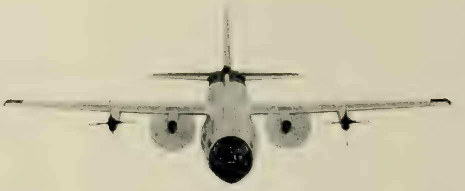
Lt Morgan said he'd had no discrepancies on the morning flight. He'd had a hung missile, but other than that, strictly routine. Trying to be helpful, he remembered that he'd discovered his mask was leaking slightly, but of course that hadn't affected the mission. He let them assume he had not discovered the leak prior to takeoff.

The maintenance technician couldn't add much. He remembered the moisture when he'd opened the wing drain, but didn't mention it. After all, like Lt Morgan had said, there hadn't been any control problems on the morning mission.

Armament didn't add much either. They'd hurried to make the switch in aircraft, but were confident nothing had been overlooked.

Since the accident one little difference had become a habit of the maintenance technician. He made it a rule to get up earlier—no matter what—and to leave the house on time. "Of course not," he had replied when his wife asked if they were blaming him at all because 326 had crashed. "But I'm going to be sure I have time to check every thing carefully."

Driving out to the base the morning after the investigation had been wrapped up, he kept mulling it over. Like that electronics specialist had said, "Any number of things could have caused it. Probably some small item somebody overlooked . . . nothing you could put your finger on." ☆



PITCH LOCKED OPERATION

Most flight crews of the C-130 are thoroughly familiar with all aspects of the Hamilton Standard propeller/Allison T-56 engine combination. To test this knowledge, here are two simple questions that just might win you a couple of beers at the club.

QUESTION 1: Suppose the T-56 engine is driving the propellor in flight at 100 per cent RPM and the blade angle locks in this condition. In shutting down the engine, decoupling is experienced and blade angle does not change. If airspeed and altitude are held constant, what will happen to the RPM of the propeller?

(a) The RPM will not change. ☐
(b) The RPM will increase. ☐
(c) The RPM will decrease. ☐

QUESTION 2: Considering a free-wheeling propeller (decoupled in the gear box) and a fixed blade angle (locked pitch) in which of the following flight conditions will the propeller windmill at the greater RPM?

(a) 150 KIAS at Sea Level. ☐
(b) 150 KIAS at 25,000 feet. ☐
(c) The same RPM under both conditions. ☐

Adapted from a MATS Flyer article by Jack G. Gilley, Lockheed-Georgia Company

If you selected answer (c) for question 1 and answer (b) for question 2, you are qualified to write the next article on propellers. If you selected any other answer for either question—read on!

There have been at least two incidents involving the Hamilton Standard 54H60 propeller in which serious overspeeding occurred after an attempt had been made to feather the propeller from what was apparently a pitch locked condition.

The first such occurrence was experienced during a test program on another type of aircraft which had a slightly different prop control arrangement from the C-130. Misrigging of the power lever combined with a switch failure in the pitch lock block out feature of the propeller resulted in high internal leakage and inability to pitch lock. Oscillograph records showed the normal increase in blade angle after initiation of feathering, however the feathering oil reserve was quickly depleted because of leakage. Subsequently, centrifugal twisting moment drove the blades toward the low pitch stop with an attendant decoupling and overspeed. The magnitude of the overspeed was significantly increased because of the pitch lock system being electrically disabled.

The second incident involved a C-130B which experienced a pitch lock in flight. This was the result of improper assembly of the propeller governor causing a gasket to blow in the control oil system. During flight the overspeed was not significant and the power level was retarded to maintain RPM within limits. As letdown was started at destination, RPM decayed with power reduction and a decision was made to feather. When the condition lever was placed to feather (the low oil quantity light was extinguished) things got extremely interesting as the engine decoupled and the tachometer pegged out.

In both of these instances the flight crew had been confronted with a propeller malfunction resulting in pitch lock and had experienced overspeeds of 140 per cent to 160 per cent RPM when they attempted to feather by following the existing handbook instructions. In one case the causes are well documented; however, in the case of the C-130 the exact sequence of events is not known because of the lack of recording instrumentation. Regardless, the propeller must have decreased pitch in order for the overspeed to have occurred.

Now for the answer to question number 1. It was obvious that something had happened to the pitch lock assembly which allowed down pitching of the blade angle (movement toward flat pitch). When the blade angle of a driven propeller does not change and airspeed and altitude remain constant, decoupling of the propeller will *always* result in a decrease in sustained RPM.

For example, in cruise flight at a specific gross weight and altitude, 200 knots calibrated airspeed will require 1425 HP per engine and a propeller blade angle of 53 degrees will govern the engine at 100 per cent (1021 prop rpm). At this same blade angle a windmilling, decoupled propeller will rotate at 82 per cent (840 rpm) at the same altitude and airspeed.

Study of the propeller pitch lock mechanism indicated that under certain conditions of low oil supply and/or internal leakage at RPM below the pitch settings, pressure surges could develop which would unlock the pitch lock mechanism and allow down pitch during an attempted feather. This was substantiated by dynamic tests on a whirl rig at the Hamilton Standard factory.

Other incidents besides those noted indicate that an overspeed can also occur if feathering is attempted with the propeller pitch locked and driving the engine at negative torque and on the fuel topping governor. If the propeller is incapable of driving the blade angle toward feather (no NTS) the added shaft torque resulting from shutting off the fuel can cause the propeller and engine to decouple. The pitch locked propeller will then overspeed with no change in blade angle.

With this knowledge, the changes to existing procedures were coordinated with all concerned and the Safety Supplements were issued. Essentially, continued operation of the pitch locked engine is recommended, using the engine fuel topping governor to control the RPM of the propeller maintaining a high blade angle to assure minimum drag, until a suitable landing area is reached. Then, follow Dash One "Engine Shutdown With Pitch Locked Propeller" procedure. This procedure is designed to prevent serious overspeed or excessive drag.

It was recognized that while in the cases reported the overspeed did not seriously overstress the propeller, the situation did nothing to improve the condition of the crew's nerves. Also, sustained overspeed could cause failure of the engine gear box and associated hardware. Just as serious was the drag which was created by the windmilling prop and the potential effect on range.

Now for question 2 and its relation to the WARNING note in the handbook in the paragraph on "Engine Shutdown with Pitch Locked Propeller." The reduction of airspeed to the lowest practical speed is extremely important if overspeed occurs during shutdown.

The resultant windmilling speed is almost a direct function of *true* airspeed, *not indicated*. The windmilling speed of a propeller with a 40 degree blade angle is a mere 820 rpm at sea level at an indicated air speed of 170 knots, increasing to 1220 rpm at 175 KIAS at 25,000 feet and reaching approximately 1450 rpm, or over 140 per cent at 35,000 feet and 175 KIAS. However, if a true airspeed of 175 knots is maintained at each altitude, the windmilling speed will be very close to 820 in each case.

Considering this data, it is obvious that at high altitude cruise conditions the true airspeed will normally be high enough to cause serious overspeeds if blade angle down pitch is experienced. If shutdown of a pitch locked propeller is dictated by other conditions a reduction in airspeed is certainly in order. If an overspeed does occur, immediate slow-down will reduce the overspeed. A slow descent to a lower altitude will allow continued flight at a more comfortable indicated airspeed.

For the C-130 operator the problem boils down to four distinct phases.

(1) Recognition of pitch lock when it occurs and elimination of those factors (synchronizing and synchrophasing) which may be causing the condition.

(2) Acceptance of the fact that sustained overspeeding to fuel governor setting is a good indication that the propeller control can no longer increase blade angle: therefore cannot be relied upon to feather the propeller, and may even unlock the pitch lock and allow down pitching when feathering is selected.

(3) Operation of the engine to maintain RPM above the pitch lock setting until a suitable landing area is reached. In other words, use the engine fuel governor to control the RPM of the sick prop until shutdown is dictated.

(4) When the landing area is reached, or shutdown is mandatory, follow the "Engine Shutdown With Pitch Locked Propeller" instructions in the handbook. Keep the true airspeed down during descent and, if overspeed occurs, remember that the best condition is *low and slow.*

The loss of feathering capability through malfunctions in the hydro-mechanical control system is not a peculiarity of only the Hamilton Standard 54H60 propeller. The problem is known to exist on other electrohydromatic propellers on both turboprop and reciprocating engines. The decoupling feature of the T56 engine installation merely adds some new factors. Continued operation in pitch lock instead of immediate feathering is just one more new principle to learn and follow. ☆

Lt George E. M. Kelly, 30th Infantry, on 10 May 1911, became the first military officer to be killed while piloting a heavier-than-air craft. Unfortunately, his fate has been shared by others in the history of flight. This is the chronicle of . . .

THE FIRST ELEVEN

By Norman E. Borden, Jr., Wapping, Conn.

Fifty and more years ago, the causes of the first serious aircraft accidents experienced by the Army's new Aviation Section of the Signal Corps bore an amazing similarity to the reasons for accidents today. A careful look at the first 11 fatal crashes in Army flying shows that, though the earliest accidents were different because the airplanes were different, the circumstances which led to disaster were not. The most common factor, pilot error, was often augmented by the failure of flying personnel to understand or allow for the operational limitations and the deficiencies of the equipment they flew. Those early airplanes were often structurally weak or aerodynamically poor because they had, of necessity, been designed by the trial and error method.

To Wilbur and Orville Wright should go the credit for instituting a safety of flight program whose general principles are carried on in the USAF by the Director of Aerospace Safety today. And like many more modern flying safety measures, the first aircraft modification to make flying less dangerous was made as the direct result of a catastrophic accident. Then, as now, men learned to fly more safely because they were able to profit from the mistakes they made.

Wright Model B, rear view, at North Island, 1913

■ On 10 February 1908, the Wright brothers were awarded a contract to build and deliver the world's first military airplane—the two-seat, twin-propeller, single-engine Wright pusher-biplane which later became Army Airplane Nr 1. The machine was taken to Ft. Myer, Virginia, late in Ausust. By early September, Orville Wright was astonishing the world with public demonstration flights preliminary to the formal Army acceptance trials which were to begin on 17 September. Late in the afternoon of the 17th, Orville took off from the launching track that had been erected on the Ft. Myer drill field. As passenger, he carried a member of the Special Aeronautical Board appointed to conduct the trials, 1st Lieutenant Thomas E. Selfridge of the Field Artillery.

Orville circled the field for three or four minutes at an altitude of approximately 150 feet. His airspeed was about 40 miles an hour. On the fifth time around, part of one of the propeller blades was seen to fly away from the airplane and fall to the ground. At about the same time, Orville was heard to shut the engine down. Then he started a gliding approach to the field. While still 75 feet in the air, the airplane fell into a spin. It was completely wrecked when it crashed after less than a turn.

Structural failure was blamed for the accident. Subsequent investigation revealed that Orville Wright first heard what he believed to be a light tapping in the vicinity of the right propeller, which was the one on his side of the airplane. A crack had developed in one of the hand-carved wood propeller blades, flattening the blade and setting up a severe vibration. This, in turn, lossened one of the wires supporting a steel tube which housed the propeller shaft. The unsupported shaft permitted the rotating propeller blade to swing around and cut the stay-wire to the vertical fin and rudder on the right side of the aircraft. Orville killed the engine at the first sign of trouble, but could not prevent a spin when con-

Wreck of the Army's first Wright airplane. Orville Wright, who was piloting, survived. Passenger, Lt. Thomas E. Selfridge, was the first man in the world to be killed in a plane.

trol of the rudder was lost. In the crash, Orville's skull was fractured and his left leg broken. The 26-year-old Selfridge, who was killed instantly, became the first man in the world to lose his life in an airplane accident. Selfridge Air Force Base is named in his memory.

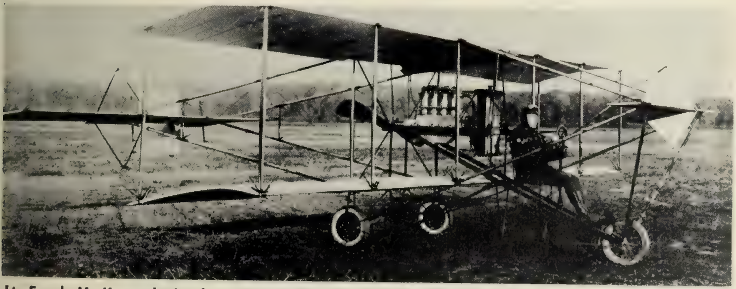
After Orville recovered, the airplane was rebuilt and the design modified to prevent the brace wires from ever being able to foul the propeller again. The acceptance tests were resumed at Ft. Myer in July 1909 and the recommendation of the Special Aeronautical Board that the Army airplane be accepted were approved by the Chief Signal Officer of the Army on 2 August. The machine, which was later numbered S.C. (for Signal Corps) 1, reposes today in the National Air Museum at the Smithsonian Institution.

March 1910 found America's infant air force flying from the mounted drill ground at Ft. Sam Houston, Texas. Here, the Army's only pilot then on flying duty, 1st Lieutenant Benjamin D. Foulois, and a handful of enlisted men conducted a series of flight tests and experiments with S.C. 1, all by themselves, for nearly a year. On 12 March 1910, only about a week after he had made his first solo while teaching himself to fly, Foulois was almost thrown from his seat on top of the lower wing when the ship encountered turbulent air as Foulois was coming in to land. After this narrow escape, he had the saddler of a Field Artillery battery install a leather strap on the pilot's seat to be used as a safety belt. From this moment on, Foulois saw to it that safety belts were standard equipment for all U.S. Army aircraft. But, for some unexplained reason, it was not for another three years that the U.S. Navy made the use of safety belts in airplanes mandatory. This came only after Ensign W. D. Billingsley, Naval Aviator Nr 9, fell 1600 feet to his death in the water near Annapolis when he was thrown from a Wright hydroplane on 20 June 1913.

■ Late in March 1911, Lieutenant Foulois of Ft. Sam Houston was joined by three more pilots, Lieutenants Paul W. Beck, George E. M. Kelly, and John Walker, all of whom had just been taught to fly by Glenn Curtiss at North Island, near San Diego. New aircraft had also arrived. S.C. 1 was retired on 4 May 1911 after it had been replaced by a single-seat Curtiss training biplane, S.C. 2 and a new Wright Model B, S.C. 3.

The morning of 10 May, Lieutenants Foulois, Beck, Kelly and Walker and Wright Company pilot Frank Coffyn breakfasted together at about 0500. It was their custom to fly early in the morning to take advantage of the relatively calm air at that time of day. At 0610 Kelly took off for a practice flight in the Curtiss trainer, S.C. 2. He crashed while trying to land on the mounted drill ground, 10 minutes later.

Kelly's landing was an exceptionally hard one. When the front landing wheel of the ship's tricycle gear struck the ground, the shock broke the seat supporting fork, which was a main structural member of the landing gear. The broken front ends of the fork stuck in the earth. This broke a bamboo outrigger which supported the horizontal elevator at the front of the airplane. Kelly applied power and was soon airborne again. In an effort to avoid a row of tents along the edge of the drill ground, he made a sharp turn while still very low. The weakened airplane dove straight for the ground, hitting left wing first. Kelly was thrown from his seat when his safety belt snapped. He hit the ground 20 feet away, breaking his neck. When he died a few hours afterwards, he became the first American military aviator to lose his life while piloting an aircraft. Kelly Air Force Base is named for him.



Lt. Frank M. Kennedy in the Curtiss trainer, S.C. 2, at College Park in 1911, after the aircraft had been rebuilt following Lt. Kelly's fatal crash at Ft. Sam Houston. Later, this same airplane killed Lt. Joseph D. Park in Calif. Lt. Kennedy, himself, crashed in a similar plane.

ABOUT THE AUTHOR: Norman E. Borden, Jr., Lt Col USAF (Ret) graduated from Kelly Field in 1931. He is presently an Engineer at Pratt & Whitney. During WW II he served as Aircraft Accident Investigating officer at several bases. He has written a book on the early history of American flying and, in the course of preparing material for this book, wrote the accompanying article expressly for *Aerospace Safety* magazine.

After the crash, the knife blade-type switch under the pilot's seat that was used to short out the ignition and kill the engine was found in the open position, indicating that Kelly had not tried to shut down his engine. As a result of this accident and upon Lieutenant Beck's recommendation in a letter to Glenn Curtiss, the hand switch for stopping the engine was moved to a more convenient location and the seat supporting fork was redesigned to make it stronger.

Judged by modern standards, the early airplanes were frail little craft. Yet, for all the fun poked at them, they were surprisingly well constructed. In the factories of the Wright Company, the Curtiss Aeroplane Company and the Burgess Company and Curtis, the wings and other parts were skillfully built by woodworkers, seamstresses and metalsmiths who prided themselves on the quality of their workmanship. But, when the pioneer aircraft crashed, as they often did, they did not come to an end in a pile of twisted metal, nor did they explode into many pieces, or burn, as planes sometimes do today. Instead, they simply folded up. And when the ships were repaired or rebuilt, they were frequently put back together in accordance with the whim of some pilot or mechanic and the dictates of whatever material happened to be most readily available. Even in the factories, there was no exact standard of construction. Therefore, no two airplanes were precisely alike and each had its own individual peculiarities.

■ After Kelly's death, the Signal Corps flew for over a year without another fatality. Then, on 11 June 1912, civilian pilot A. L. Welsh of the Wright Company with Lieutenant Leighton Hazelhurst as passenger crashed during an acceptance demonstration flight of a new Wright Model C scout plane at the Army's flying school at College Park, Maryland. Both were killed instantly. During WWI, Hazelhurst Field near Mineola, Long Island, was named in memory of Lieutenant Hazelhurst.

■ Rockwell Field, for many years an Air Corps supply depot on North Island in San Diego Bay, was named for Lieutenant Lewis C. Rockwell. About three months after Welsh and Hazelhurst had been killed at College Park, Rockwell completed his pilot training at the same facility. On 28 September, he took off shortly after 1600 hours in a Wright B, S.C. 4, to take the required flight test for the rating of Military Aviator. The ship's crew chief, Corporal Frank S. Scott, went along as passenger. After circling the field a few times at about 500 feet, Rockwell descended in a glide at a reduced throttle setting until he reached about 100 feet. On approaching the hangar line, he appeared to open his throttle. The engine responded with a roar, whereupon the aircraft dove to the ground. The crash killed Corporal Scott and so seriously injured Lieutenant Rockwell that he died three hours later at Walter Reed Hospital.

Rockwell's accident can be charged to his inexperience—he did not allow for a treacherous characteristic of the early Wright biplanes. The engines of these ships were mounted just a little off center, on top of the lower wing. The pilot and passenger or student sat on the wing beside it. But the propellers were mounted at about the center of the right and left wing bays. Thus, the center of thrust of the propellers was a number of inches above the aircraft's center of gravity. When the airplane was in a glide at a near stall condition, the nose of the machine had a tendency to pitch-down sharply when full power was applied suddenly. Because the horizontal elevator was mounted relatively close behind the wings and was therefore rather ineffective at very low airspeed, the early Wright B and C airplanes, possessed a built-in booby trap for the unwary pilot, one of whom was Rockwell.

■ When winter weather late in 1912 necessitated that the school at College Park be closed, Signal Corps aviation activities were divided into two sections. One was moved to Augusta, Georgia, and the other went to the field that Glenn Curtiss was operating at North Island in California. On the afternoon of 8 April 1913, an instructor at North Island, Lieutenant Lewis H. Brereton, took a new student, Lieutenant Rex Chandler, on a training flight in a Curtiss flying boat, S.C. 15. They had been practicing takeoffs from San Diego Bay for about an hour and a half when the aircraft lost altitude during a right turn close to the water. The lower wing on the inside of the turn touched the water and the flying boat cartwheeled near the place where the Point Loma ferry was crossing the bay. The ferry boat cap-

Orville Wright demonstrated the first airplane for the Army at Ft. Myer, Va. The Plane crashed during acceptance trials.

tain saw one of the victims floating in the water and picked him up. It was Lieutenant Brereton who was badly bruised but otherwise not injured. He asked for aid for the man he said was pinned under the airplane wreckage. When the ferry reached Lieutenant Chandler, they found him dead.

■ Also at North Island, a month later on 9 May 1913, Lieutenant Joseph P. Park took off at 1720 for Ascot Park, near Los Angeles, flying the rebuilt Curtiss S.C. 2 biplane in which Lieutenant Kelly had been killed at Ft. Sam Houston. When he had covered 108 miles of the flight after two hours and 40 minutes flying, Park encountered a heavy mist and lost his bearings. He landed near a school at Olive, California, just north of Santa Ana, to orient himself. A few minutes after taking off at Olive, Park hit a tree on a hilltop with one of his wings. The aircraft crumpled into a heap of bamboo, wire and fabric, killing Lieutenant Park.

■ The next fatal accident occurred two months after this at Texas City, Texas, when Lieutenant Loren Call lost control of his ship while making a turn at 200 feet over the flying field. The Accident Investigation Board suspected some sort of structural failure of the Wright C biplane. The date was 8 July 1913.

■ At North Island, 4 September 1913, Lieutenant Moss L. Love took off early in the morning from San Diego Bay for a practice flight in a Burgess-Wright hydroplane, S.C. 18. After climbing to 2000 feet, he started a wide, gliding turn. When Love opened his throttle at 300 feet the machine nosed almost straight down. When the hydroplane hit the water in a vertical dive, Love was killed. The Accident Board found all of the hydroplane's controls intact, which led to the conclusion that Love had fallen victim to the same aircraft design characteristic which had killed Lieutenant Rockwell.

There were two more accidents before 1913 drew to a close. On 13 November, Lieutenant Perry C. Rich, flying a Wright Model C, S.C. 12, was killed in the Philippines. While flying solo, he circled the ships anchored in Manila Bay, then cut his throttle and started a glide over the water. Witnesses said that once Rich commenced his glide, he was never heard to reopen his throttle. Although the glide was normal at first, it grew steeper and steeper, finally ending as a perpendicular dive. The left wing of the aircraft hit the water first. When the engine was torn from its mount, it hit Rich on the head, causing his death. Cause: undetermined.

■ There seems but little doubt that the tricky rotational characteristic of Wright-type aircraft under certain conditions was responsible for the death in a Wright biplane of Lieutenant Eric L. Ellington, for whom Ellington Air Force Base is named, and his student, Lieutenant Hugh M. Kelly. The morning of 24 November at North Island, Ellington took off to give Kelly some practice landings. After a short flight, the aircraft was observed to be making what appeared to be a normal gliding approach for a landing. When Ellington and Kelly were still about 75 feet in the air, the engine was heard to respond to a full application of power. The aircraft then dove straight to the ground, killing both the instructor and his student.

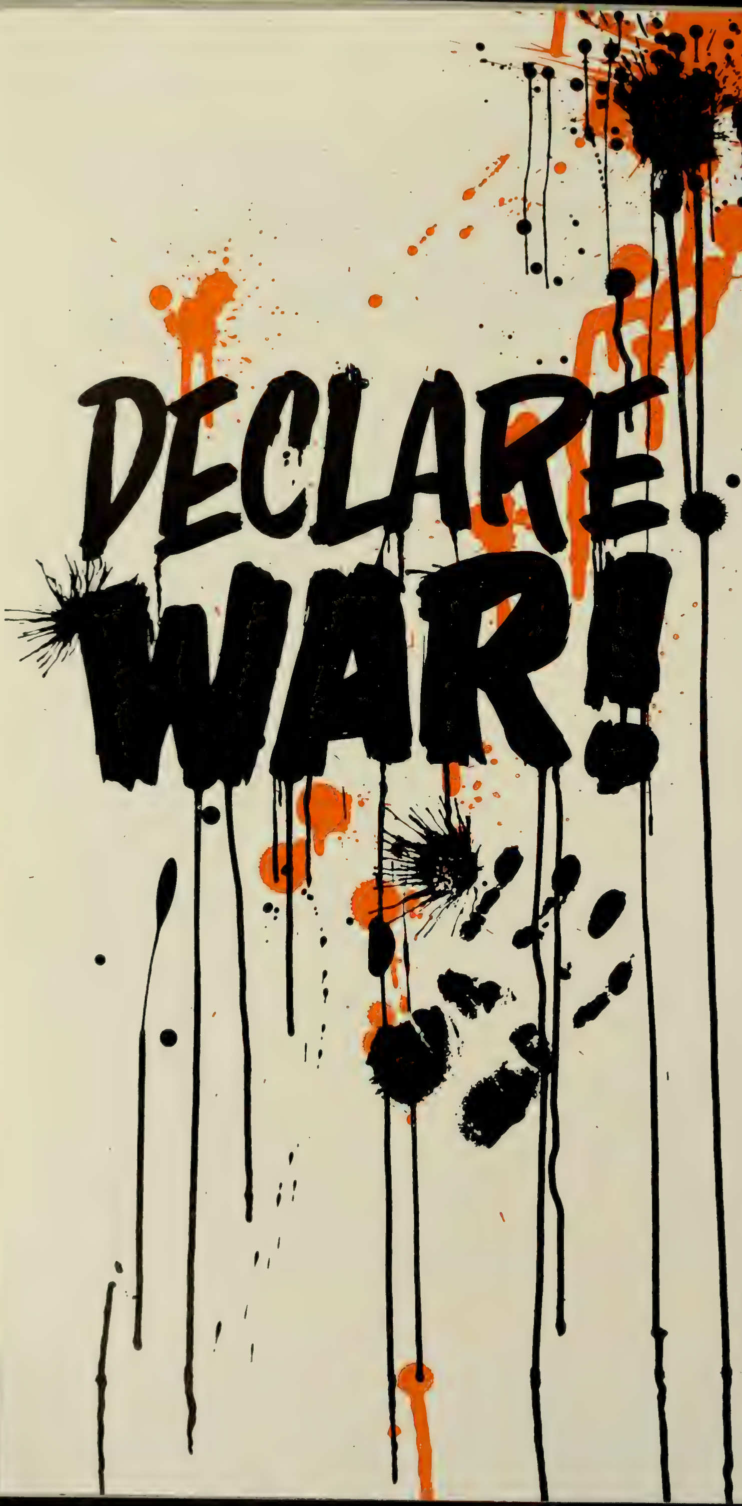
In December 1913, the Aeronautical Division of the Signal Corps issued a statement summarizing the achievements of Army aviation up to that time. Since 1908, the War Department had purchased a total of 28 aircraft. One had been given to the Smithsonian Institution and nine had been destroyed by accidents. The remaining 18 were in the Philippines, Hawaii, Texas and San Diego. Of the 40-some men who had received flight training, ten, or approximately 25 per cent, had been killed in crashes, and a disheartening number of those who survived had requested to be relieved from aviation duty.

■ On 9 February 1914, there was another fatal accident at North Island. Earlier, on 18 December the year before, Lieutenant Henry B. Post had set a new Army altitude record when he reached 10,600 feet. On the morning of 9 Februrary, he tried to better this in a Wright C, S.C. 10. His barograph later showed that he reached 12,120 feet, setting a new American record for both military and civil aircraft. After Post had gone as high as he could, he must have decided to return and land as quickly as possible. Those watching saw him diving very fast. The right wing of his aircraft collasped in flight when he was 600 feet over the water of San Diego Bay. The airplane fell into the bay at 1040 hours. Post was dead when a civilian instructor at North Island, Francis Wildman, reached the scene of the crash in a flying boat.

The structural failure which caused the death of Post was the eighth in a series of accidents involving Curtiss and Wright-type pusher biplanes. These had started with Rockwell's accident in September 1912 and included the disastrous flights of Brereton, Park, Call, Love, Rich, Ellington, and now Post. Oscar Brindley, who had formerly been chief instructor at the Wright flying school at Dayton and was then a civilian instructor at North Island, reported that he considered all the aircraft at North Island to be in bad condition. Brindley suggested that they be rebuilt. The Accident Board which investigated Post's accident recommended on 23 February 1914 that all the Wright and Curtiss pusher biplanes at the station be condemned as they were no longer safe to fly.

It was decided to rebuild all of the older Army airplanes, including the Burgess-Wrights. But the Wright and Curtiss pushers would be flown only after they were overhauled and modified to make them safer until new equipment could be procured. This arrived late that summer in the form of the new Curtiss JN-1, forerunner of the famous JN-4 "Curtiss Jenny." By the end of 1914, 11 JN-1s had been received, these being the first relatively modern type tractor biplanes with protected cockpits and a reasonably complete set of cockpit instruments to be used by the Signal Corps. The passing of the open-seat pushers marked the end of the pioneering era of flying in the United States Army. But those who lost their lives during the 1908-early 1914 period did not die in vain, for their experiences have served through the years to help others avoid the pitfalls into which they had fallen. ☆

Airplanes and hangars at the U.S. Signal Corps flying school, College Park, Maryland, 1911.



DECLARE WAR!

Maj Clifford J. Galliot
Directorate of Aerospace Safety

"Traffic accidents can be greatly reduced. But there are no shortcuts, no quick or simple cures. Slogans, gimmicks, and drives yield no lasting benefits."

The above is a quote from the Highway Safety Action Program developed by the President's Committee for Traffic Safety. It pinpoints in a few words what the Air Force should have realized a long time ago. However, during 1963, a total of 442 Air Force military personnel lost their lives in automobile accidents. These appalling facts are proof positive that Air Force efforts in this area have not been effective; that these efforts may have been too passive and not sufficiently positive.

NEW LOOK NEEDED

The need for a new look at Air Force-wide efforts to prevent automobile accidents is clearly evident. Since the inception of ground safety in the Air Force, too much reliance has been placed on slogans, gimmicks, drives, and other such shortcuts. The "soft sell" boys have tried their way, and the results have been safety programs based mostly on safety gimmicks, persuasion, and reward. Military discipline frequently has been subjugated as an accident prevention measure, and disciplinary action considered by many as incompatible with the safety effort.

We have listened to the disciples of Heinrich, the "Father of Industrial Safety," and patterned our safety efforts along civilian/industrial lines. This concept, although successful for its intended non-military purpose, failed to take into consideration the basic Air Force safety problem: That traffic accidents are largely identified with our younger personnel.

In failing to recognize this problem, we also fail to discharge basic "parental" responsibilities for the young people in our care. Busy commanders have permitted safety technicians to preempt their safety responsibilities, and the technicians could only respond with more safety gimmicks, persuasion, and bigger trophies. Seemingly we have forgotten that we are a military organization with technical control over our personnel 24 hours a day, every day in the week.

The results have been just about what could have been expected. Safety gimmicks, persuasion, and offers of bigger awards have been successful to a degree. We have succeeded in reducing our motor vehicle accidents and resulting fatalities a part of the way. The bulk of the problem remains, and these accidents continue to take a heavy toll.

Vehicle accidents in the Air Force can be further reduced. An opinion to the contrary, based on the false premise that inherent hazards on the highways make it necessary to accept these accidents is a fallacy, pure and simple.

MILITARY APPROACH

A hard-nosed military approach to this problem is needed. It is now time to organize our vehicle accident prevention efforts along military concepts, tailored to meet military needs, and conducted by military commanders. It is now time to take the actions that can and must be taken if we are to reduce these accidents. Every individual on a base must be made to realize that failure to conform to good driving practices will not be condoned; that personnel with repeated traffic violations, or those involved in accidents, will invite the personal attention of the commander.

Obviously, the key man to take these actions is the commander. A commander can generate a great deal of interest in safe driving by making the following announcement at his next staff meeting:

"Gentlemen: At 1400 hours, Friday afternoon, two weeks hence, I will hold a meeting in the base theater. Attending this meeting will be all military personnel who have been responsible for an automobile accident or have received a citation for a moving traffic violation during the past 12 months. The Security and Law Enforcement Officer and the Ground Safety Officer will work together on this. They will screen the ground accident reports and AF Forms 1313, 'Driver Record,' and identify the personnel who will attend. Unit commanders will be given a list of the selected personnel and will personally escort their people to the meeting. No exceptions will be made unless the individual is in the hospital. On Friday afternoon, three months from the first meeting, and every three months thereafter until further notice, I will hold similar meetings. All military personnel involved in automobile accidents or receiving moving traffic citations during any intervening three-month period will attend the next meeting. Personnel required to attend more than one of these meetings will be considered repeaters and will be identified for further action. The commander of any repeaters, accompanied by the individuals concerned, will report to me at 1000 hours the Saturday morning following the meeting. The unit commander will be prepared to tell me, in the presence of each repeater, what specific action he has taken or will take in regard to the individual's poor driving performance.

. . . on traffic accidents

"The Information Officer will give maximum publicity to this program in the base newspaper. Any questions?"

POINTS FOR CONSIDERATION

We are confident that the unit commanders can take it from there. It would be presumptuous to tell them what to say at the meetings or what action to take against the repeaters. There are, however, a number of points that are offered for consideration:

- The ultimate success of this program depends on the effectiveness of the commander's actions.
- For maximum effectiveness, the program should be conducted for at least one year or as long as accidents and traffic violations make it necessary for personnel to attend the meetings.
- Firm and positive implementation of the requirements of AFR 125-14, "Motor Vehicle Traffic Supervision," is indispensable to the success of this program. The driving performance of each individual must be fully reflected on the AF Forms 1313, "Driver Record." This means that every accident, every citation, and every action that has a bearing on the individual's ability to safely operate a motor vehicle must be entered on his record.

Obviously, the man on the red-hot seat during the tenure of this program will be the unit commander. It is he who will have to take disciplinary or administrative action against the repeaters, and it is he who will have to meet the commander face to face on those fateful Saturday mornings. That is the way it should be. When the heat gets too intense—who knows? Some unit commanders may find a way to share the hot seat with first-line supervisors and other NCOs, and that's all to the good.

At this point, a couple of areas should be clarified. Nothing in the foregoing is planned to downgrade the value of our safety promotional programs. These programs have proved their value, and are a necessary part of a balanced effort. Nor should every man who has an accident be immediately drummed out of the service. Disciplinary actions should be on a selected basis and directed at the more hardened offenders. It is our belief, however, that a more positive approach to the traffic accident problem is a must if we are to reduce our fatalities. Many commanders have taken disciplinary action in support of their safety efforts and have achieved excellent results. We believe that others can.

A final thought. The usual hue and cry can be expected from some quarters that "you can't do this." These are the same people who, all along, have come up with thousands of reasons why effective action cannot be taken against flagrant traffic violators. But this is hogwash and poppycock. It takes a different kind of leadership than that to stop these accidents, and the Air Force has those leaders at every level of command. Our long and successful history has proved it.

During war and peace we have found solutions to even more perplexing problems. This is another kind of WAR. Let's win it. ☆

HOUSEKEEPING IN THE SPACE AGE

Lt Col M. E. Hollis, Directorate of Aerospace Safety

In almost every area, technology meets the basic requirements of the space age. However, housekeeping procedures have not advanced much beyond the horse and buggy age. To prove this point, all you have to do is to observe the cleaning of a HGM-16F (Atlas) silo after a major spill of hydraulic fluid, diesel fuel oil, or lubricating oil. The use of rags, soap and water or a cleaning solvent (trichlorethylene), and lots of elbow grease is the approved cleaning procedure.

In most cases, horse and buggy age housekeeping procedures were adequate until the advent of liquid-fueled ballistic missiles, such as the HGM-16F (Atlas). The Atlas F, for example, is housed in a silo during standby alert. An eight-level crib structure with grated flooring covering approximately 180 degrees of the 360-degree circumference of the silo, is located between the missile enclosure area and the silo walls. Consequently, dirt, debris, water, oil, and fuel from upper levels will fall or drain to lower levels if not promptly removed.

Diesel engines, fuel and oil tanks, and hydraulically operated equipment are located on Level 6 and above in the HGM-16F silo. LOX transfer and storage equipment are located on Levels 7 and 8. Spills and leaks of hydrocarbon fluids, if not promptly contained and removed from the silo crib structure and equipment, will penetrate lower levels and contaminate the LOX system. Hydrocarbon contamination of a LOX system can result in a catastrophe.

Everyone in the missile business today recognizes good housekeeping as an essential ingredient of accident-free operations. Unfortunately, the need for space age housekeeping procedures was not recognized until many missile systems were operational. Although this need has been recognized for some time, little or no progress has been achieved in solving the problem.

One reason for the lack of progress in the state of the art (cleaning) is that the problem seems to generate more emotion than sound, logical, scientific thought. Everyone seems to be looking for a perfect solution to the problem. They want a cleaning agent that is nontoxic, noncorrosive, LOX-compatible inexpensive, and one that requires little or no equipment and manpower. This is as it should be. However, we should not expect to achieve the ideal in one big leap forward. A more realistic approach would be to progress step by step toward our ultimate goal. This is the way we progressed from the Wright brothers' airplane to the space age!

A portable steam cleaner, for example, meets all the requirements of a perfect cleaning method with one exception—steam increases corrosion problems; consequently, some people violently oppose its use. However, present cleaning procedures (soap and water) probably cause more corrosion than does steam. The use of more effective cleaning agents is opposed because they are either toxic, corrosive, or not LOX-compatible. It should be noted that although soap is not Lox-compatible, it is used; trichlorethylene is toxic, yet it is an acceptable cleaning agent.

Someone has to look at all these arguments objectively and make a decision. In the case of the portable steam cleaner, the criteria should be: (1) Does its use increase the probability of an accident? (2) Are the added corrosive effects of steam a more serious problem than hydrocarbon contamination? If the answer to both questions is "No," it seems that this system should be adopted until a better method is found.

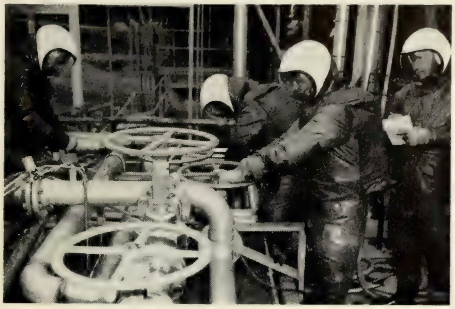
In proposing the use of a new cleaning agent that is toxic, corrosive, or not LOX-compatible, consider the following: (1) Does it increase the probability of an accident? (2) Is it more corrosive than accepted cleaning agents? (3) Is it more toxic than accepted cleaning agents? (4) Does it increase chances of hydrocarbon contamination of the LOX system? (It should be noted here that when a LOX-compatible cleaning agent removes, absorbs, and mixes with a hydrocarbon substance, it is at that moment *not* LOX-compatible.)

If the answers to the above questions are "NO," and the agent is a more efficient cleaner and/or requires less time and manpower, propose its use. New cleaning agents, equipment, or procedures, must in all cases be submitted to the proper agencies for testing and approval in accordance with existing directives prior to use by field activities.

The responsibility and procedures for testing and adopting new cleaning materials are clearly outlined in TO 43A1-1-1. MOAMA is charged with the responsibility for insuring that cleaning materials and processes meet the requirements of the Air Force mission. Personnel must be encouraged to be watchful for new cleaning material, equipment, and processes which will improve our ability to get the job done. Proposed new procedures and cleaning agents should then be forwarded to MOAMA, through the AMA for the particular commodity involved. Read TO 42A1-1-1 for details.

Each advance will help reduce accident potentials and assist in achieving our goal of a zero accident rate. ☆

MISSILANEA



PASA-JELL—Recently a corrosion control team was cleaning a portion of the outer skin of a Titan (LGM-25C). The procedure called for cleaning compound Pasa-Jell, Stock Nr 6850 L500507-4660, to be brushed on the surface to be cleaned, and then agitated with aluminum wool for 10 minutes. During the agitation procedure, the wool started to spark. Flame was extinguished immediately with no damage or injuries.

Local tests and tests conducted by The Martin Company, Denver, produced similar results in that Pasa-Jell is not compatible with steel wool or aluminum wool. Under laboratory conditions at Denver, steel wool, when saturated with Pasa-Jell, started to smoke and emit sparks almost immediately. It took the aluminum wool about five minutes to react.

There are four types of Pasa-Jell, namely, 101, 102, 103 and 104. Each is designed for a job on different metals. If you are to use Pasa-Jell, make certain that you are using the proper type for the equipment involved.

The Air Force Ballistics System Division is correcting technical orders concerning the proper use of Pasa-Jell. Commanders, maintenance officers and safety officers whose organizations use Pasa-Jell in conjunction with corrosion control activities should take a close look at their procedures and equipment to insure that no hazards are present due to its use. All corrosion control personnel should be briefed on the dangers involved.

Lt Col Driskill B. Horton
Directorate of Aerospace Safety

FUEL RULES—Here are some basic safety pointers that apply to RP-1, as well as other liquid fuels:

- In the event of a fuel spill, wash all affected clothing and skin surfaces thoroughly with large amounts of water. Change clothes as soon as possible and request medical assistance.
- Insure that all spills on floors, roadways or the silo cap area are promptly cleaned up. Where possible, washing with large amounts of water is the best and quickest method.
- Increase ventilation to reduce vapor concentration and provide personnel with self-contained breathing equipment during cleaning operations.
- Insure that all ignition sources, such as smoking, are not permitted where fuel vapors may be present.
- Keep all fuels and oxidizers well separated.

Maj L. G. Miller
Directorate of Aerospace Safety

FALCON LOADING—Preloading inspection had been performed on all launcher rails and all indexing feelers were pushed forward to retract the hold-back pins and umbilical plugs. In loading rail Nr 4, some binding was encountered after front launcher hooks were on the rail and beyond the indexing followers. The hooks on both sides of the rail were inspected and found to be properly engaged on the rail. The missile was then backed off the rail until launcher hooks reached the indexing feelers. Missile binding increased. The missile was moved forward approximately three inches to clear the indexing feelers so that they could be pushed forward and insure the retraction of the hold-back pin. The release knob was pulled; however, no forward movement of the indexing feelers could be obtained. The indexing feelers were raised to clear the launcher hooks and the missile was removed from the rail.

A close inspection of Nr 4 launcher rail revealed the hold-back pin was partially extended when the missile was started on the rail. The mechanism that extends or retracts the hold-back pin was binding and the indexing feelers would only go forward if struck sharply several times after the release knob was pulled.

The damaged missile fuselage had to be shipped to the depot and the Nr 4 launcher rail to the aircraft company for repair.

PREVENTION—Thorough preloading inspection of all launcher rails to insure that hold-back pins are fully retracted can prevent this type of missile damage. ☆

Lt Col Loren S. Tyler
Directorate of Aerospace Safety

As long as there are aircraft to fly and men to fly them there remains the frightening potential of midair collision. While all pilots share the dread of such an occurrence, the military pilot is unique in that not only must he contend with the possibility of collision with a strange aircraft, but also on occasion he flies formation with the attendant risk of colliding with a wingman.

Following are two articles written by students at the Flying Safety Officers' Course at the University of Southern California. One deals with a near miss that probably would have resulted in catastrophe had a collision occurred, the other with a collision that took place between two aircraft in formation. The authors have a number of suggestions for prevention of midair collisions. AEROSPACE SAFETY recommends careful reading of both articles.

KEEP YOUR DISTANCE

GET TUNED

Captain Russell D. Greenberg

Have you ever been involved in a midair collision? If not, may I tell you about the one I had? Perhaps my misfortune will serve as a warning to others.

You have heard the old cliche, "A midair will spoil your whole day." Believe me, it will. Only in my case it happened at the worst time—night.

Picture, if you will, an Air Defense Command alert hangar. It is early evening and everyone has just finished the evening meal. The crews are gathering around the alert commander to receive the night mission briefing. Weather, good as gold. Mission, instrument practice approach at a nearby civilian field. Flight of two—the wingman acting as observer. Radar observers, understandably, observe the scenery and everything else going on.

After the general briefing, I got together with my wingman to discuss in detail the flight we were about to make. We mutually agreed that I would lead and make two or three approaches. Then he would make the last approaches.

By the time we were preflighted it was dark. It was one of those crisp fall evenings that make flying a pleasure—even at night.

I could see my wingman was about ready for start. He was a good pilot. His RO was a good observer. They were a good crew. We were a good flight. Ignorance was bliss.

We were flying an old reliable F-94C. It was stable. It was a "goin' Jesse," one of ADC's top interceptors for that time. It was rugged. These qualities were about to be proven again.

Now for the circus, I took off first (naturally, I was the leader) and made a left turn out of traffic. My wingman was to follow and join up after takeoff. I remained at low altitude since the civilian field was only 40 miles away.

"I've lost you in the turn," the radio crackled. This surprised me somewhat so I called my heading and gave him an afterburner light. He should be able to see that.

"Do you have a Tally Ho?" I barked with a bit of impatience.

"Negative," was the reply.

I came inboard on the throttle to save fuel. If he hadn't seen six to eight feet of flame he wasn't about to find me.

"I'll make a three-sixty and pick you up in the turn," was my next action.

This I did and with great luck. I found him easily and joined up.

"Joined up," was my call.

"Roger," he replied.

After a few minutes I crossed over to the left wing and called him to let him know what I had done. He acknowledged.

I then decided it was time for me to lead again (since, after all, I was the leader) and told him to drop back and I would assume the lead. He acknowledged.

At this time we were in a right turn around the city. The field was on the other side. I began mentally figuring out the best way to get reversed on the ILS and begin my practice approaches.

I checked the wingman and he was dropping back in the normal manner. I added a little power and told my RO that I was going on the clocks.

We continued our turn for about another 90 degrees and were about to roll wings level when my RO yelled, "HEADS UP."

Instinctively I looked to my right and banked left. As I did so I saw nothing but airplane belly and rivets. The rivets were so close I could see them in minute detail. My navigation lights were lighting up his aircraft.

There was a sickening thud, bump and quiver of man and machine. We had collided.

I immediately rolled wings level and started climbing for altitude and ideas. The RO was asking a few pertinent questions like, "Will we make it?" "How does it feel?" and "Are we getting out?" I had to hand it to those brave souls in the back seat. I was too busy to answer.

I had good control despite a few missing parts on the right side and a bent wing.

My wingman was having trouble also. The collision had flipped him on his back and as I rocked my wings on the pull up I looked for him to see how he was doing. He was just rolling wings level and recovering at a much lower altitude.

"Are you OK?"

"Roger, I think so. It's yawing quite a bit but I think it's OK."

We limped back home and after much experimentation landed without too much difficulty.

Airplanes—rugged. Pilots—severely shaken. Radar observers—silent.

What had gone wrong? At the time I felt that I should have stayed in bed.

Let's back up a little and go over the facts. We had briefed the mission. But how thoroughly had we briefed? He lost sight of me on the turn out of traffic. Was it really necessary to fill all the squares in one flight? Did I really need a chase airplane?

I had called that I was joined up, crossing over, and taking the lead. All calls were acknowledged.

These are all facts brought out in the investigation. But, as the board brought out also, why were we flying around together both on the gages?

With experience comes wisdom. Looking back I believe the problem originated in communication — or rather the lack of it.

As an illustration, take either a novice pilot or a person with no experience in flying and listening to an airborne radio. Let him listen to a radio transmission or a recording of transmissions. Ask him what they said and chances are he could not understand a thing that was said in the conversation.

Now, take the same individual and let him listen to many recordings or airport tower transmissions over a period of landing or departing aircraft. Eventually he will project himself into the scene or situation so that he can tell exactly what is going on. He will "get tuned" to the situation. He will get into the act himself and even if some of the transmissions are slightly garbled, he will know what is next and be able to decipher more readily what was said.

What does this have to do with preventing a midair collision? The same way many other midair collisions could have been prevented. By getting tuned. By projecting one's self into the situation. By adapting oneself to the situation.

It takes practice and concentration. It can be attained through standardization. It can be attained through good, concise briefings. Briefings on even the most routine missions. It can be attained by knowing what's going on overall. Project yourself ahead of the mission.

All this is dependent on one main point. When you project yourself into the mission it means leaving all the abstract thoughts in the locker. Forget about the office. Forget about small problems at the bar or at home. Get Tuned.

Come down to the airplane with only one thing in mind—*FLYING.*

EYES OUTSIDE

Major W. R. Riley

A few months ago I experienced what I prefer to call a "near catastrophe." The occasion was my arrival at the Travis terminal in a C-135 with a full load of passengers. The flight had been direct from Yokota, Japan, to Travis. We approached Travis in the middle of the afternoon, with clear weather and excellent visibility.

We arrived over the Travis TVOR at 20,000 feet, under radar monitor, and were cleared for penetration. Following station passage I established a descent of 4000 feet per minute at 250 knots. The copilot, engineer and myself were cleaning up the remaining items on the descent checklist. As we passed through 14,000 feet the copilot happened to catch a startling sight out of his side window. He immediately yelled, "There's an airplane!" I looked out the window, and fear tied my stomach in knots as I simultaneously jammed the throt-

tles forward and pulled the airplane into a climbing turn, passing across the top of the other aircraft at an estimated 200-300 feet. We had been descending directly into a Constellation approaching from our three o'clock position. The Connie continued on its way without altering flight path; the pilots obviously had never seen us. After collecting our wits, we asked Travis RAPCON if they had painted the Connie on radar; they assured us they had not. Had my copilot not *happened* to glance out of his side window at that precise instant, we assuredly would have scattered 81 passengers and crew from our airplane, plus an unknown number from the Connie, across the brown California hills. And the Air Force would have had a catastrophe to investigate.

We have had two other near collisions in our squadron in recent months. Both were under conditions similar to my experience; descent in terminal areas, on IFR clearance under radar monitor, and in excellent visibility conditions. In both cases the collision was avoided because a crewmember saw the other aircraft in sufficient time to take evasive action.

Since the first occasion on which two airplanes flew in the same airspace at the same time, pilots have had the problem of avoiding other aircraft. Ernest K. Gann in his book "Fate Is The Hunter" tells how he, flying as a brand-new captain on a DC-2, missed another airplane by 50 feet on a night flight to New York. In more recent years some of our worst air disasters have resulted from midair collisions.

Three recent ones happened under conditions of good visibility. The collision of an F-100 and an airliner over Las Vegas occurred in broad daylight, as did the collision of two airliners over the Grand Canyon. The collision of a MATS C-118 and a Navy aircraft over Long Beach occurred at night. These disasters could have been avoided if, in each case, one of the pilots had seen the other aircraft in sufficient time for evasion.

The moral is obvious. Radar, although a valuable aid, has many limitations, and cannot under VFR conditions guarantee positive traffic separation. Light aircraft frequently do not appear on radar screens. Radar controllers are not required to report VFR traffic; they may do so if not otherwise occupied. Area positive control is an aid for high altitude jet traffic, but is of little comfort to lower altitude traffic and to jet traffic upon descent into the lower altitudes in terminal areas.

The only positive way to avoid other aircraft in conditions of good visibility remains, as it has since the first aircraft flew, the use of 20/20 vision. The hoary saying, "see and be seen" is of even more importance in today's increasingly crowded airspace and fast, sophisticated aircraft than it was in the day of the Curtiss Jenny. Until such time as a device for positive aircraft avoidance is manufactured, the pilot who does not maintain a good outside scan is quite likely to be a dead pilot.

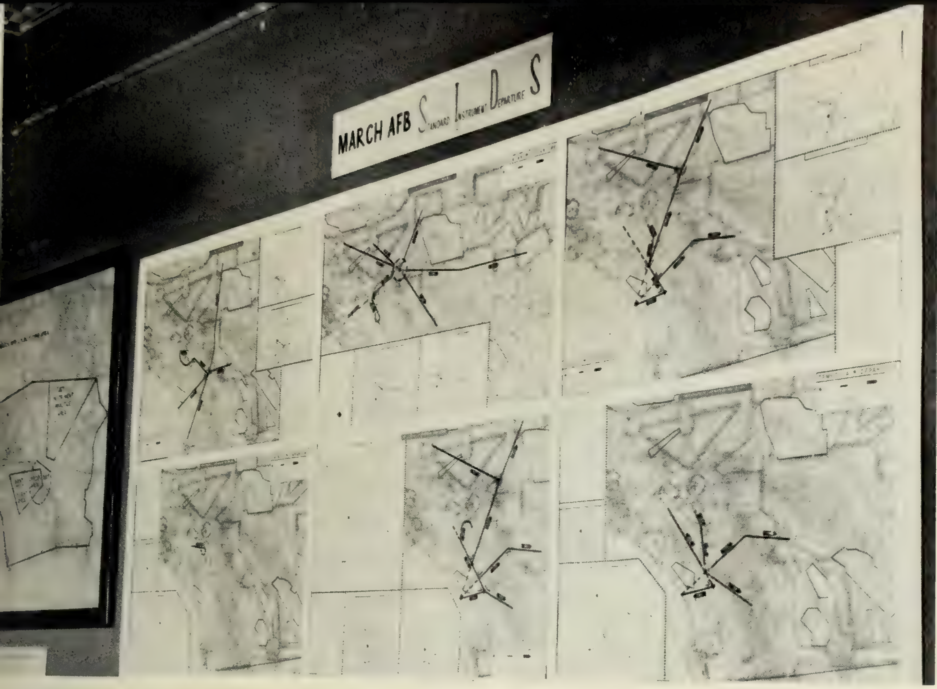
Commanders and supervisors must make every effort to allow the pilot to maintain a good outside watch. Pilots should not be required to accomplish long checklists in terminal areas. Cockpit duties during approaches and in crowded areas should be kept to the absolute minimum required to fly the aircraft. If operational necessity requires "head in the cockpit" occupation during these phases of flight, then the operational requirements should be changed. It will be much easier to do this than to attempt to explain away another military-airliner catastrophe.

Immediate steps must be taken to improve the near-collision reporting system. From my experience in talking to pilots, I estimate that three out of every four near-collisions are not reported. There are several reasons for this state of affairs, but the primary reasons are natural pilot reluctance and lack of education in the necessity for prompt and accurate reporting.

Military reporting procedures have been changed so often and disseminated so poorly that the average pilot does not know how to report a near-collision. Quick and accurate reporting is absolutely essential if the FAA and the military are going to keep abreast of hazardous or potentially hazardous airspace areas. But quick and accurate reporting will not become a fact until all pilots, civil and military, are given some sort of protection and are educated as to the necessity for reporting.

Finally, we in the safety business are responsible for teaching pilots that in order to survive they must "keep their heads out." We share the responsibility for convincing our pilots that each near-collision report may prevent a future disaster. We are responsible for continuing the fight for increased cockpit visibility in new aircraft. And we have the duty of keeping our commanders informed of hazardous traffic areas in our respective operations.

What endeavor could be more worthwhile? For midair collisions are among the most senseless of all aircraft accidents. And they are almost invariably fatal. ☆



Sid Display
AIDS PILOTS

Maj Richard K. Buckland
22 Bomb Wg, March AFB, Calif

A NEW FLIGHT PLANNING AID in
he March AFB flight planning
oom has become the center of at-
ention at Base Operations here,
nd has been the cause of numerous
avorable comments from members
f 15th AF Staff, Flying Safety
fficers, and pilots in general, par-
icularly transients.

The Base Operations Officer at
arch was constantly aware that
he combination of mountainous ter-
ain, weather conditions and high
ensity air traffic in the March AFB
rea could pose a difficult and some-
imes confusing problem for the
ransient pilot when preparing a
ight plan. Almost daily, pilots were
bserved struggling with charts,
otters, computers, and dividers to
terpret the Standard Instrument
epartures (SIDs) and fit them into their flight planning. Feeling that flying safety begins with flight planning, it was decided that there was a need to provide the pilot with better and more graphic pictures of the departure routes.

Experiments were made with several different methods of presenting the SIDs before the present display was completed. To be effective, the displays had to be large enough to be easily read and interpreted at a glance, and had to depict the necessary departure information without appearing cluttered.

The final result was a 20 X 30 plate which incorporates the actual SID as published by ACIC, an area sectional chart, and en route airways charts for the appropriate altitude structures. The actual flight path of the departure route is drawn on the sectional chart so that a pilot may see at a glance the terrain features over which he will be flying and the proper relationship to radio facilities to be used. Also prominently shown is the magnetic course of each leg of the departure to be flown, and Warning and Danger Areas which he might encounter. The published SID is shown as an inset for quick reference so that the pilot can make a mental note of the comparison between his printed SID and his flight path, and also that he may better understand the reasons for specified headings, altitudes, etc., which he will fly. To further aid the planning phase of his flight, the departure route is again shown on an inset of each en route airway chart for which that departure is appropriate. This gives the pilot a quick reference for planning the airways which he may wish to use or avoid upon completing his instrument departure and transitioning into the en route portion of his flight.

There is a separate plate displayed for each of the six published SIDs. Each is prominently labeled by name and indicates whether it is a Jet, Conventional, or Jet *and* Conventional departure. They have quickly become one of the most frequently referred to planning aids, and many pilots (both base assigned and transients) have commented that they are a valuable contribution to continued flying safety at March AFB. ☆

Aerobits

FASTEN IT! When a pilot has to eject he wants everything possible going his way. As has been stated frequently on the pages of this and other publications by a number of different people, the helmet is extremely important to the pilot's survival in an ejection situation. Nevertheless, there still is an occasional death or serious injury in which failure to retain his helmet cost the pilot dearly. In a recent case, it is suspected that the pilo failed to secure his chin strap and did no lock his helmet visor prior to ejection. Th helmet was found near the canopy. Damage appeared to have been caused by impact with the ground. The visor was partl down, the friction knob not tightened.

Remember, Fasten It!

SAVED BY A JIGGLE. A recent nonreportable incident, involving an ATC T-33, brings out the importance of the gear handle "jiggle" check on final. This T-33 was on a GCA monitored ILS final. Gear was placed down and three safe indications were obtained prior to glide slope. On final the GCA controller advised to check gear down and locked. The pilot reached down to "jiggle" check the gear handle and it moved very freely up and down. Each time the handle was raised slightly the gear would unlock and "barber poles" show in the selsyn indicators. The weight of the gear handle itself was just enough to produce a safe indication. The pilot went around and during investigation in flight a slight porpoise or any maneuver other than positive "G" force would unlock the gear. The button on the gear handle was stuck in the depressed position. The gear handle was held down by the navigator in the rear cockpit until the gear pins were inserted on the runway after landing. Maintenance investigation revealed that the gear handle in the front seat had been bent inboard at some time causing a binding on the gear handle button linkage. In this case the "jiggle" check revealed a condition in time to prevent an accident. The gear would most probably have collapsed on landing roll if the condition had gone undetected.

Capt Riddering, FSO,
Tyndall AFB, Fla., ATC

THE WANDERER—The sortie on which this accident occurred was scheduled to be a high altitude mission of 6+15 hours duration in an overseas area.

Approximately four hours after takeoff, the aircraft started its overwater leg with slightly over two hours expected time en route to destination. Nearly an hour later the first celestial shots were attempted. When the heavenly bodies could not be located after the computed information was set into the sextant, it was apparent that a gross navigational error existed. Several additional celestial observations were attempted without success. When the heading check on Polaris revealed about 60 degrees difference between desired and actual aircraft heading the crew tried to get high frequency direction finding steers.

At the expiration of their proposed time en route, the crew and destination ground station were still trying to determine the plane's exact position, and a low fuel condition was declared. At this time the aircraft was nearly 600 NM north of and flying directly away from destination. During the next hour, the aircraft was positively identified and position plotted with the ground station giving true heading steers to destination, which were followed oy the crew. Despite the known N-1 and Doppler equipment malfunctions, the rew continued to follow the true headings iven them by the ground station, which vere later displayed on the radar scope is being about 50 degrees in error. No inslaved or free running gyro procedures vere used.

When approximately 170 NM out, the ircraft began a very gradual descent and wo engines were shut down to conserve uel. When approximately 130 NM out nd descending through 24,000 feet, the rew shut down two more engines. At 06 NM the aircraft passed through 19,00 feet. Shortly thereafter the aircraft vas leveled off at 13,000 feet approxinately 85 miles out.

With engines one and four operating, he aircraft was vectored for a straight-in, ong, flat final approach.

After the landing gear and flaps were owered, the pilot added power and the ircraft rolled to the right. Number one hrottle was retarded and the aircraft anded short of the runway. The gear heared and the aircraft burst into flames s it slid across a parking ramp, damagng a parked aircraft.

The copilot stated he was inadvertently jected from the aircraft at initial touchlown. The three remaining crewmembers xited through the canopy opening when he aircraft came to a stop.

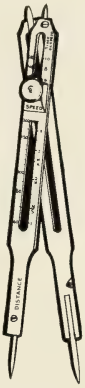
Recommendations as a result of this accident include:

- If a pilot or navigator can see Polaris, a reasonably good guess of direction can easily be determined. If, for example, Polaris is directly ahead of the aircraft (regardless of height) and the desired track is west, it is very obvious that the aircraft heading is about 90 degrees out of phase and immediate steps must be taken. Particularly when flying over water it is a good idea to cross-check all heading changes with the standby mag compass.

- When a flight crew is unable to determine the position of the aircraft by normal navigation procedures, every available navigational system must be employed to locate the aircraft position. If there is still doubt that the aircraft is where the flight plan predicted, an emergency should be declared so that all available ground and airborne assistance can be rendered to help the crew of the lost aircraft fly to the nearest landing base.

- If the engines are shut down for any reason and a landing is to be made with less than normal power available, the final approach should be very carefully planned to insure that adequate power will be available and that no asymmetric power factors will aggravate the problem.

Lt Col David J. Schmidt
Directorate of Aerospace Safety



MISTAKEN IDENTITY. Upon arrival over the destination fix, the T-33 was cleared for an ADF approach to a municipal airport. The aircraft broke out of all clouds at 3000 feet MSL, 1300 feet above the ground. At this point the pilot sighted an airfield he believed to be his destination and began a straight in approach—disregarding instructions contained on the letdown plate to make a 40 degree turn and track to an LF beacon. By this time he was so convinced he was right that he paid no attention to the destination tower operator when he advised, "I do not have you in sight." Without receiving clearance to land, he landed on a 3700-foot wet runway at the wrong airport. The pilot then braked his aircraft to a stop by use of speed brakes, tiptanks, flaps and belly when the gear parted company with the aircraft as it left the far end of the runway.

It has happened before and probably will again. But it won't happen to you if you:

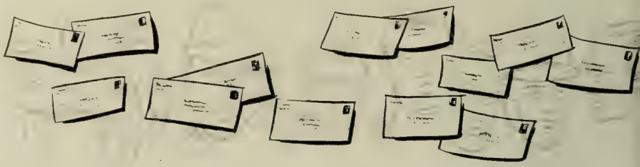
- Study the approach to your destination and alternate (it's more likely to happen at an alternate).
- Follow the letdown instructions.
- Don't land unless you are cleared to land.
- Wake up when the tower operator says, "I don't have you in sight"; you may be the victim of . . .

MISTAKEN IDENTITY ☆

Courtesy ATC's "Approach to Safety"

FALLOUT

(continued from page 1)



The events leading up to the incident are as follows: Our crew was scheduled for a night refueling mission. The take-off time was 2020 local and the flight was to be 7:00 in duration. At 0330 on the same day, my wife quite unexpectedly went into labor and I rushed her to the local hospital. I was with her until 0900 and then returned home to arrange for a baby-sitter for our other child. This was accomplished by about 1230 and I finally got to bed at 1300 to rest for the flight. Due to the excitement earlier in the day I did not sleep very well and woke up at about 1530 with a severe headache. I got ready for the flight and arrived at base operations at about 1730 for final mission planning. The headache was still with me so I bought a small box of headache tablets at the Base Ops snack bar and downed a couple of them. They helped a little. (Perhaps at this point I should note that I think I could have had emergency leave had I not been so gung-ho for the squadron. We were, and still are, desperately short of copilots and realizing the nightmare our operations officer was having with scheduling, I did not push the subject of emergency leave when advised of the problems involved. I could have gone over his head to the CO and Wing, and probably have gotten it, but I really didn't want to.)

We launched on schedule at 2020. Things went quite well considering how hectic some missions are. All the while I was taking headache tablets to calm my aching head (I was getting a cold too) and drinking what seemed to be gallons of coffee to keep awake. My AC did all the flying that night since I was quite busy plotting ten-minute fixes for the navigator and fulfilling my other duties as chief radio operator. I was doing quite well and completely unaware of my condition until we started descent for landing. Actually I was in some kind of stupor from the headache tablets and coffee. There probably is a medical term for it but I don't know what it is. I was due a landing (after about 45 days without one) so the AC and I traded control of the aircraft and checklist.

Somehow I was able to fake my way through the whole thing and I don't think that my AC realized what sort of a near panic dilemma I was in. My cross check was super slow, we were in weather, it was very dark, and for about one minute I experienced vertigo so severely I nearly screamed in panic. This was my first experience with vertigo in nearly 1200 hours of flying but I realized it as such and the only thing that kept me from telling my AC to take the aircraft was that I absolutely stared at the attitude indicator and flew it without reference to the other instruments. The AC was busy talking to approach control and running the checklist with the engineer, but they both soon noticed the airspeed 25 knots low and falling off. They advised me of this and at about this time we broke out of the overcast. I regained control of myself but I was thoroughly frightened. (This all took place within two or three minutes after I took control of the aircraft.) It goes without saying that the approach and landing were rather erratic but *we* made it. I emphasize the fact that *we* made the approach and landing because I feel that as surely as I am sitting here tonight typing this letter, had I been flying alone that night in a fighter (I have had some small amount of experience in the T-Bird and the F-86L) I would this day be a statistic and my wife a widow. And it was all caused by a little box of headache tablets and a gross amount of personal negligence.

I consider my self a fairly good pilot and a helluva lot smarter after this incident.

Name Withheld by Request

THE INNER MAN

I was quite interested in the article "The Inner Man" by Dr. A. F. Zeller in the February issue of *Aerospace Safety.* My experience with a similar problem may help explain why such problems are not brought out.

About two years ago I was in a situation where one has two equally bad alternatives, i.e., damned if you do and damned if you don't. The pressure built up over a period of almost six months, and I noticed the effect on my performance both in and out of the cockpit. So having no intention of buying the farm, I went to the Flight Surgeon for advice. He sent me to a psychologist who duly noted I was nervous, tense, and depressed but which constituted no hazard in the cockpit. The situation eased and things got back to normal shortly thereafter. But about a year later, another Flight Surgeon saw the notation about depression on my record and got all shook up about it, couldn't clear me for flying without a waiver for my "mental condition." I was interviewed by a local head shrinker who said, "You're fine, couldn't be better." Then I had to go to Brooks for a real going-over. The psychiatrist there also agreed that there was no psychological deficiency. However, the thorough physical did find a minor deficiency that is not now a barrier to flying but in 10 or 15 years may be one (I am now 40.)

To cap it off, I was offered a regular commission this year, something I have desired, but when my physical was reviewed I was rejected because of my "mental condition" and the other deficiency.

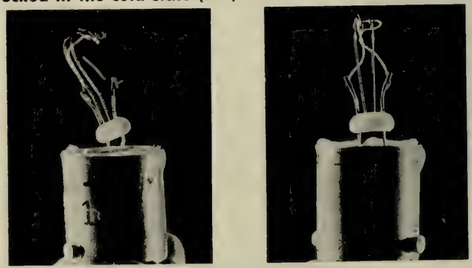
To sum it up, my career has been detrimentally affected and I now have to get two waivers to stay on flying status. What other effects my indiscretion will have on my career I do not know. But with situations such as this, it is certainly no surprise that your friendly Flight Surgeon does not have more cooperation from his victim.

Name Withheld by Reques

This letter represents one point of view. How about some others? ☆

CORRECTION

Pictures, illustrating the Aerobit "Let There Be Light" in the April issue, were inadvertently reversed. They have been reprinted below, showing what happens to a small filament shocked in the cold state (left) and in the heated state.



WELL DONE

CAPT. ROBERT L. SMITH

4781 COMBAT CREW TRAINING SQUADRON, PERRIN AFB, TEXAS

While on a student training mission on 11 September 1963, and upon turning to the base leg, Captain Robert L. Smith noticed that the main landing gear position indicator light of the TF-102A was not illuminated. Captain Smith immediately assumed control of the aircraft and executed a go around. He directed the student to recycle the landing gear and then attempted to extend the gear using the emergency gear extension, but without success. Fuel remaining was approximately 800 pounds. Captain Smith flew another closed pattern, yawing the aircraft and "pulling G," but could not obtain a down safe indication. Due to the critically low fuel state, he then elected to make an approach end BAK-9 barrier engagement. When established on final approach, Captain Smith directed the student to jettison the canopy and extend the arrest hook. Both systems operated normally. In a wings level attitude, Captain Smith flared the aircraft over the runway overrun and held the left main gear approximately one foot in the air. At 145 KIAS, and while the aircraft was still airborne, the arrest hook engaged the BAK-9 barrier. Upon engagement, the aircraft immediately contacted the runway on the left main gear, sheared the nose gear strut below the fuselage, and shortly thereafter settled on the right wing tip. The aircraft came to a halt 735 feet down the runway. Captain Smith and his student were unhurt and immediately evacuated the aircraft. Captain Smith's skill and ability as a pilot are particularly impressive due to finesse required to engage the BAK-9 barrier on the approach end of the runway at this base. An MA-1 barrier system is installed 55 feet in front of the BAK-9 barrier. The time factor dictated by the critical fuel shortage in this instance, precluded its removal prior to BAK-9 engagement. The arrest hook of Captain Smith's aircraft contacted the surface of the runway overrun 12 feet in front of the BAK-9 barrier. Through his calm judgment and outstanding display of professional airmanship, Captain Smith undoubtedly saved the Air Force a valuable aircraft and averted possible injury to himself and his student. His superior performance in the face of an emergency reflects great credit on Captain Smith, his organization, and the United States Air Force. ☆

For Meritorious Achievement in Flight Safety for the period 1 January through 31 December 1963, the units listed here have been selected to receive the Air Force Flying Safety Plaque. The stringent criteria insure that each recipient has achieved an outstanding flying safety record while maintaining mission capability.

Flight Safety Awards

AAC	• 5017 Operations Squadron, Elmendorf AFB, Alaska
ADC	• 18 Fighter Interceptor Squadron, Grand Forks AFB, North Dakota
	• 87 Fighter Interceptor Squadron, Lockbourne AFB, Ohio
	• 78 Fighter Wing, Hamilton AFB, California
ATC	• 3575 Pilot Training Wing, Vance AFB, Oklahoma
MATS	• 1502 Air Transport Wing, Hickam AFB, Hawaii
	• 1370 Photo Mapping Wing, Turner AFB, Georgia
PACAF	• 45 Tactical Reconnaissance Squadron, Misawa AB, Japan
	• 40 Fighter Interceptor Squadron, Yokota AB, Japan
	• 90 Bombardment Squadron, Yokota AB, Japan
SAC	• 100 Bombardment Wing, Pease AFB, New Hampshire
	• 416 Bombardment Wing, Griffiss AFB, New York
	• 376 Bombardment Wing, Lockbourne AFB, Ohio
TAC	• 314 Troop Carrier Wing, Sewart AFB, Tennessee
	• 27 Tactical Fighter Wing, Cannon AFB, New Mexico
	• 363 Tactical Reconnaissance Wing, Shaw AFB, South Carolina
USAFE	• 49 Tactical Fighter Wing, Spangdahlem AB, Germany
	• 10 Tactical Reconnaissance Wing, RAF Alconbury, England
	• 86 Air Division, Ramstein AB, Germany
	• 81 Tactical Fighter Wing, RAF Bentwaters, England
AFRES	• 434 Troop Carrier Wing, Bakalar AFB, Indiana
	• 452 Troop Carrier Wing, March AFB, California
ANG	• 163 Fighter Group, Ontario Intl Aprt, Ontario, California
	• 131 Tactical Fighter Group, Lambert Fld, St Louis, Missouri
	• 138 Air Transport Group, Municipal Airport, Tulsa, Oklahoma

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FLYS

AEROSPACE

SAFETY

UNITED STATES AIR FORCE

DAEDALIAN FLYING SAFETY TROPHY WINNER

JUNE 1964

AEROSPACE SAFETY

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VOLUME TWENTY NUMBER SIX — USAF RECURRING PUBLICATION 62-1

FALLOUT

BUTTON GUARD

The photograph accompanying the article "There's Time to Think," (Feb) did as much for me as the article itself. It stimulated my memory of an incident which occurred to me, and I am curious to know:

a. Was the photo used with the article as a plant—to see how many would notice? If not:

b. I wonder just how many birds are actually flying with the propeller feathering button guard around the "Top" where it provides no protection.

With the guard around the top of the feathering button (as shown in the pic), it is very easy to inadvertently feather a propeller, for example, with your head while entering the pilot's or copilot's seat. When this happened to me, I thought it was just one of those "one in a million" cases. But after seeing your article and photograph, I'm convinced there could be more, and this situation could be more than just embarrassing.

Capt William T. Gosnell
Safety Officer, 2223d Instr Sq (CONAC)
Dobbins AFB, Ga.

It's always encouraging to hear from sharp-eyed readers, but NO, the picture was not used as a plant. The artist selected it as representative of an example in the article. Thanks for writing.

FAA ADVISORIES

Your comments in "FAA Advisories" (December), were very interesting and important. I feel that not enough emphasis is placed on FAA's role in military flying.

Since our Flight Information Publications and FAA rules and regulations are constantly being improved and changing, I feel that a page in each *Aerospace Safety* should be devoted to "FAA Advisories."

Capt Ross L. Meyer, USAF
Selma, Alabama

TOO COZY

We find your article, "Too Cozy," (November issue) very well don and would like your permission t reprint all, or part of the article for distribution to scientists an other interested persons who migh not receive your publication. Also if possible, we would appreciate receiving several copies of the sam issue or tear sheets for our immediate use.

Robert B. Sleight, Ph.D.
Pres., Applied Psychology Corporatio
Arlington 7, Virginia

FACTORS IN ANG SAFETY

Although the annual Air National Guard Safety and Commanders Conference, scheduled for 21-23 May, has been cancelled, ANG achievements in safety since their first safety conference in 1957 deserve notice. Since then the ANG flight accident rate has declined to its present low mark comparable to that of the active Air Force. It is quite apparent that commanders and their key staff personnel have accepted, and applied, sound safety policies to all phases of operational and maintenance activity. And it is significant to note that the Guard's present flight safety rate was developed concurrently with increased operational activity, very closely aligned with their active force counterparts.

Additional mission requirements of recent years make the lowered ANG rate even more significant. Jet fighter deployments to overseas bases, mid-air refueling of both ANG and regular component aircraft by ANG tankers, global airlift missions in support of MATS and participation in large scale multi-service exercises such as Swift Strike are examples of operational requirements that have emphasized the necessity of preventing accidents.

The quality of maintenance of many Guard units has been a prime factor in ANG safety. Maintaining the aircraft are many highly experienced men who learned their trades in the Air Force and who have taken their skills into the Guard squadrons. Their know-how and incentive to excel have overcome many problems that go with aging aircraft.

The pilots on the team are real professionals as proven by their ability to maintain flying proficiency while holding down full-time civilian jobs.

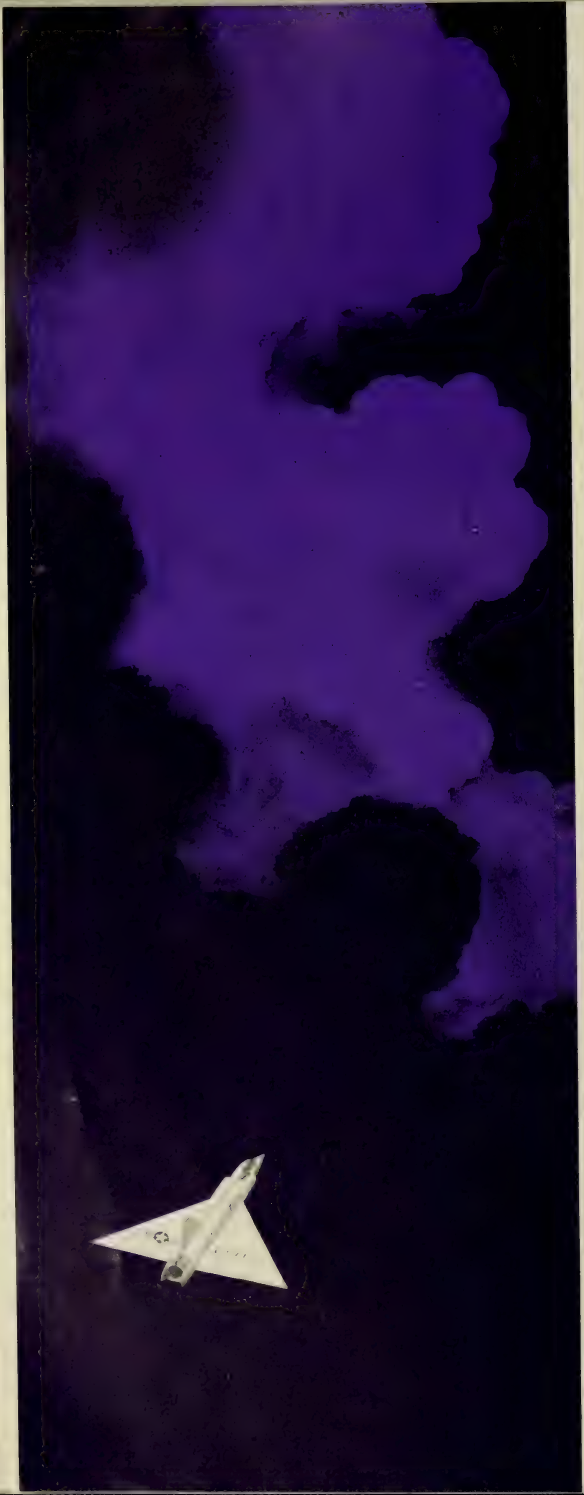
Excellent maintenance, highly capable pilots, first-class support personnel and the high caliber supervision the ANG now has combine to produce a strong and reliable supporting arm to the Air Force.

There are still areas of concern, to be sure, but with continued acceptance and application of good safety strategy, I feel optimistic that these problems too will be summarily resolved.

The Air National Guard is an integral member of the Air Force team and has accepted its share of responsibilities with understandable pride and efficiency. It can be assured of continued support of the Directorate of Aerospace Safety within the capability and resources it possesses.

Jay T. Robbins

Director of Aerospace Safety



A Project Roughrider pilot discusses flight problems and gives some tips on the handling characteristics of straight wing, swept wing and delta configuration aircraft.

PILOT EXPERIENCES IN THUNDERSTORMS

Capt Kenneth H. Coffee, Fighter Operations Div., ASD

Why, as pilots, are we interested in severe storms? First and foremost it's a matter of survival. Another good reason is the damage caused to aircraft by hail and severe turbulence. Anyone who flys stands a chance of being caught in a situation which requires flying in the vicinity of thunderstorms. The psychological effect on the pilot who may never have encountered a severe thunderstorm may be serious. There are, however, factors that can enhance safe operations.

At the present time we are much better prepared to cope with severe storms than we were a few years back. My advice would be to avoid thunderstorms i possible; next best is to ask for radar vectors around or between storm cells.

In recent years NASA, the U.S. Weather Bureau, and the Air Force were involved in a program to investigate thunderstorms. The weather bureau was interested in learning more about the physical make-up of individual storms as well as a more accurate means of forecasting when and where storms are to appear. NASA wanted to acquire structural loads data to apply to aircraft which are being designed for the future. Civil jet application was also a prime area of interest. The Air Force was involved for three good reasons, the first being an engine problem with the F-102. We were also concerned with the handling characteristics of straight wing, swept wing and delta configured aircraft. We were interested in various engine-airframe marriages.

For instance, why does the J-57 engine act differently in the F-100 or F-101 from how it acts in the F-10 when exposed to ice crystals and heavy concentrations of water? What are some operating problems peculiar to supersonic flight? What damage does lightning, hail nd water erosion do to an aircraft during a subsonic r supersonic penetration of a thunderstorm?

In this program, the Aeronautical Systems Division, AFSC, used various airplanes for thunderstorm penetrations. In 1960 we used an F-106, an F-102, and a T-33. Over 200 penetrations were made with these three aircraft. Since that was our first year of operation, much was to be learned about optimum speeds, flight control problems, FAA clearances and numerous other problems. My job while flying the F-102 was to establish throttle techniques to be used during penetration and to determine whether a continuous ignition system would prevent flameout during a long series of compressor stalls induced by ice crystals.

This would probably be a good place to mention a couple of unusual things which came as somewhat of a surprise: (1) liquid water at 40,000 feet where the outside air temperature ran well below freezing; and, (2) hailstones at 45,000 feet in completely clear air as far as five miles from the storm on the downwind side of the storm. A storm building several thousand feet in a matter of minutes is an amazing sight to behold! The reverse may occur and a storm may be gone in a matter of minutes. It is not unreasonable to observe storms building at a rate of 5000 fpm. For those who haven't seen this occur, it is really something to watch! Some of these storms top out at 70,000 feet or more. I have flown alongside a couple of storms at 50,000 feet with tops that were at least 10 to 15,000 feet above me.

Systematic procedures were established for the actual storm penetrations in order to minimize hazard and overcome some operating problems. The storms were traversed at all altitudes between 15,000 and 45,000 feet and a speed range from 175 knots IAS up to 600 knots IAS. Flight control problems were present in all aircraft but the seriousness varied with speed and also from one aircraft to the other. In the straight-winged T-33 with a .8 Mach limit, high speed or compressibility was a problem. With the airspeed near the mach limit of the aircraft, flight controls were stiff and when strong downward air currents were encountered it was hard to prevent the aircraft from exceeding its designed speed limit. This would no doubt be a problem in light aircraft as well. When the airspeed was slow (175 KIAS) in the T-33, control effectiveness was a problem. In other words, it was difficult to make the aircraft respond at the rate you would desire. Another problem at low speed was being able to maintain the airspeed with full power while attempting to hold a precise altitude during strong down currents. Each time a storm was penetrated an area of noticeable up currents would occur for a period of time as well as an area of down currents for a similar period of time. As it turned out a medium speed was best for the straight wing aircraft.

Flying the T-33 was something like riding a small boat in the ocean. There were times when it was impossible to hold both altitude and speed, so altitude was varied as necessary to maintain the desired indicated speed. The slower speed also helped reduce the turbulence problems by decreasing the effect of gusts and making for a smoother ride. Pitch control was as much a problem as roll.

In the delta wing aircraft, flight control problems were noticeably different from the straight wing. The big difference was pitch control. It was very easy to maintain any desired pitch attitude, regardless of speed. However, upsets in roll become quite interesting at times. On numerous occasions, with full aileron de-

flections against the roll, a bank of 45 degrees to 60 degrees would be attained. Again penetration speed was an important factor for consideration. It was always comforting to have plenty of speed with the F-102 in order to overcome the engine compressor stall problem. Two hundred and forty-one stalls were recorded during a single penetration which lasted approximately four minutes. As a result of this test we recommended that F-102 pilots avoid thunderstorms if possible. But if it's not possible, use continuous ignition to prevent flameout.

During 1960 the F-106 made supersonic passes with speeds up to 1.8 Mach number or about 1350 miles per hour. These penetrations were made a few thousand feet below the tops of the storm, mainly to see what would happen if someone inadvertently ran into a thunderstorm while making a high speed SAGE type intercept. The airplane responded so favorably, particularly the engine, that we decided to use the F-106 exclusively during 1961 to continue the gust loads research. We were thinking in terms of data for a supersonic transport or commercial carrier. It appeared from what NASA learned during 1960 that a speed would be reached above Mach 1 where the gust loads would level off and remain constant as well as making for a reasonably smooth flight through the storm. An analogy would be driving a car over a bumpy road where high speed gives a much smoother ride than some slower speed.

In 1961 the F-106 penetrations were made between 15,000 and 45,000 feet altitude and speeds up to 1.63 Mach number. Because of hail encounters at 1.6 Mach with extensive damage to the F-106, the decision was made to use the T-33 as a hail probe. This approach worked fairly well but it was still not the complete answer, because on two or three occasions the T-33 pilot reported no hail and a couple of minutes later the F-106 would come through the storm and get hit by hail.

Except for a couple of weak areas, the aircraft withstood the hail quite well. Actually the damage caused by water erosion was more serious than that caused by hail. Our engineers figured the impact pressure created by the water at 1.6 Mach was 18,000 pounds per square inch. This pressure would peel flush rivet heads out of the wing, particularly along the leading edge. The plexiglas canopy was worn down about one-fourth inch on the leading edge. Fiberglass antennas were worn away and had to be replaced. Most of the paint was missing after the first few penetrations. If continued flights were to be made at these high speeds, rivets and plexiglas would be of little value for external airframe construction.

Lightning was another interesting phenomenon which was encountered on numerous occasions. I feel sure there are certain storms where enough lightning is present to hit any type aircraft, regardless of size. Of all the aircraft used for penetrations the B-66 was hit most frequently. In fact, it was an excellent lightning rod. Damage to the aircraft was not extensive but I am not sure this could be said about the pilot's nerves. The aircraft became so charged with electricity that when it was discharged numerous small holes were burned in the trailing edge of the ailerons, wingtips, rudder and elevators. These same results held true with the T-33. I recall one particular storm which contained much more lightning than any other storm that I have ever seen. There were times when 15 or 20 bolts would be visible at the same time. Normally a pilot will see a flash or a lightning bolt or perhaps two or three bolts at the same time.

In addition to the lightning I was concerned about the individual who was riding in the rear seat. He was normally the "motor mouth" type but for about five minutes there was not a sound from the rear seat.

I would guess the airplane was struck by lightning 20 or 30 times during the pass with very little damage. The one thing that I clearly remember is that the hair on my head and arms literally stood on end. One time while looking toward the wingtip the aircraft discharged electricity and it appeared that a ten foot bolt of lightning left the front and rear of the wing fuel tank. A couple of lightning strikes were felt in the form of a bump. It was amazing how fierce the lightning looked yet it did so very little damage.

Naturally we experimented a great deal with various types of static dischargers, none of which worked very well. In 1962 the F-100 was equipped with 18 dischargers, three on each end of the horizontal tail, two at the top trailing edge of the vertical stabilizer and five on each wingtip. These dischargers were the only ones we used where communication was not lost some time during the storm. One discharger received a direct hit and actually fused together without doing damage to the aircraft.

During 1962 ASD chose an F-100 and a T-33 to participate in the program of collecting meteorological data for the weather bureau and the FAA. The F-100 was equipped with one high speed camera which operated at 1500 frames per second, for the purpose of taking pictures of hail. Clear pictures were never attained mainly because of poor lighting conditions. Another camera was carried for the purpose of taking pictures of water droplet size. Pictures of the water droplets turned out much better than the pictures of the hailstones. Liquid water content of the clouds was measured, and the electric field was measured in all directions from the aircraft. All these measurements were made in an effort to correlate the data with radar scope pictures for the purpose of more accurately defining the physical makeup of individual storms.

It has been my experience that what you see with the naked eye is certainly deceiving. One storm will be extremely black with only moderate turbulence and no hail. The next one may not look bad at all but as soon as you enter the storm you wonder what you are doing there. When we can look at a ground radar picture and receive an accurate evaluation of a storm a big step forward will have been made in air safety.

Much has been learned about the composition of thunderstorms and the operating problems associated with flying in this type of severe weather. But a vast number of problems remain unsolved and the weather bureau plans to continue their storm research for several years. Meanwhile my experiences have taught me to treat thunderstorms with great respect and to avoid them completely if possible. I think this would be sound advice for anyone flying because as a prophet once said, "Example is a dangerous lure; where the wasp got through the gnat is stuck." ☆

F-89 units set a new high!

SAFETY AND THE GUARD

Col Paul Fojtik, ANG Liaison Officer
Directorate of Aerospace Safety

The Air National Guard for many years has been a prominent part of the Air Force team, participating actively and capably in all facets of Air Force activity. They are included in world-wide USAF airlift missions; they are a part of probably every tactical exercise involving Air Force responsibilities; they are an integral partner in the Air Defense System; and they compete with active and reserve Air Force units for various Air Force awards.

The Guard's accomplishments certainly warrant recognition. To cite an example, the Air National Guard F-89 units last year completed the best flight safety record ever achieved by tactical aircraft utilized daily, throughout the year, in operational units. The rate for 1963 was 2.2 and, for over 11 months of the year, was 0.0! Only one F-89 accident occurred during the year.

In the aerospace safety business, it is fitting that this outstanding accomplishment be recognized. Also, in making a proclamation of this type, some speculation and comment on how this record has developed is in order.

It is true that the F-89 is an old bird—but so are many other aircraft still flying—in fact, this could very well indicate that in spite of the problems which normally develop in the "senior citizens" of the aerospace world, the units possessing the F-89 have accomplished an outstanding safety record.

It is also true that the F-89 has two engines; an engine failure is usually just an incident as compared to an accident in a single engine aircraft. But then there have been, and still are, multi-engine airplanes flying that have a far worse safety record.

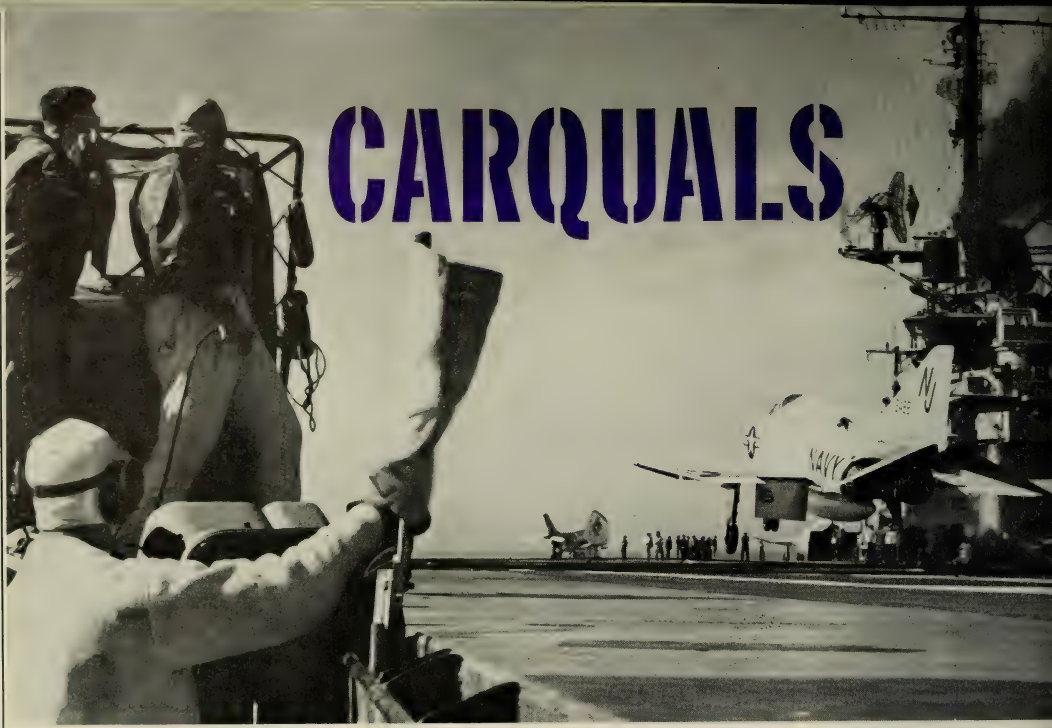
The ANG Air Technician maintenance capability is well known and very probably contributes substantially to this outstanding safety record. There certainly could be further speculation as to why the F-89 units *should* have a better flight safety record than other jet fighter airplanes. Many of these same comments could apply very well to any operational aircraft, but it just hasn't developed that way.

All of the ANG F-89 units operate in northern geographical areas, which are considered throughout the Air Force as those for which special considerations are allowed. In addition, these same units are participating in the same alert activities as active units of the Air Defense Command — they don't choose the weather conditions they fly in nor do they choose the time or the mission. Their operation is a direct parallel to active ADC units.

This is why it is in order to single out the ANG F-89 units for special commendation. They not only operate their aircraft in a manner comparable to active Air Force units, but they do it safely under climatic conditions considered by flyers as the worst in the continental United States during much of the year. These pilots do this in addition to working a normal civilian work week which is required to provide the necessities of life for their families.

There is little argument with the fact that Guard commanders, aircrews and support personnel are aware of what their jobs require and that each of their responsibilities is efficiently and energetically accomplished. These are the primary ingredients for an efficient, and safe, operation. ☆

CARQUALS



On a carrier qualification landing, a Navy pilot's F-4 is about to hook a wire.

Strange that, in this land of television watchers, few are aware of a TV spectacular series filmed a few miles off the California Coast, especially since this show is tops for suspense and raw excitement. It plays only to a select audience, well versed in the part played by each actor and the meaning of each bit of action. No matter how seasoned the viewer, it will frequently bring him to the edge of his seat. There are no commercials to break the tension, and for those who can stand the excitement, it is possible to see the program as it is being filmed. This takes more fortitude; ears must stand up under an almost constant shriek of sound; eyes have to watch men flirting with near death, or so it appears to the uninitiated; most of the vantage points provide little protection from a steady 35 mph gale.

The name of the program—CARQUAL; the producer — U. S. NAVY; cast—3500 seamen, naval aviators and a few marines; setting—USS Coral Sea, a 985 foot aircraft carrier.

We were privileged to witness and participate in the filming earlier this year through the courtesy of the producer. As the Air Force is slated to receive several hundred of one of the most important props—McDonnell F4s—we accepted, hopeful we might pick up some safety tips worthy of passing on in this magazine.

For the benefit of landlubbers, it should be explained that the television system is a closed circuit system with cameras buried in the carrier deck and screens placed in the pilots' ready rooms and other points throughout the ship. The system is referred to as "PLAT" (Pilot Landing Aid Television). It allows the viewers to make a close appraisal of the carrier landing approach from a vantage point near the expected touchdown. Furthermore, after the landing the pilot can take a comfortable seat in the ready room and view his complete approach sequence on TV tape.

SAFETY! How is it achieved with such inherent hazards as: cramped areas, the ever present edge of the deck, jet wash, wind across the deck, maneuvering aircraft, moving tugs, wires strung across the deck and, at times, rolling, pitching, rain and darkness? Obviously this is a tremendous challenge, and the Navy, through such things as training, discipline, experience, close supervision, frequent drills and critiques, meets the challenge and accomplishes their mission. To better understand this safety challenge, let's look at some typical hazards, then some solutions.

Looking down from PRIFLY (a glassed in tower-like vantage point from which all primary flight operations are conducted) we watched a plane handler pedaling backward in double time, holding the end of a steel bar with which he was steering the nose gear of a taxiing jet.

Holding our hats in the constant gale we watched another handler jump sideways, stiff legged, until he gained purchase on the deck when the jet wash of a maneuvering A-4D tried to blow him overboard.

More suspense, served in agonizing slow motion, comes with the maneuvering of a plane onto the elevator for delivery to the hangar deck. The pilot, his cockpit hanging out 70 feet above the rushing water, works brakes, throttle and steering in response to the hand movements of a signalman. Watch closely and you'll see the signalman's lips move as he coaxes the plane to follow his instructions, ever so carefully. Were he in full dress, and much older, he could use similar delicate hand movements in leading a symphony orchestra. It may just seem that way, but the pilots make straight ahead movements jerkily, in inches or less, and quickly respond to signals that move the protruding cockpit nearer the center line of the ship.

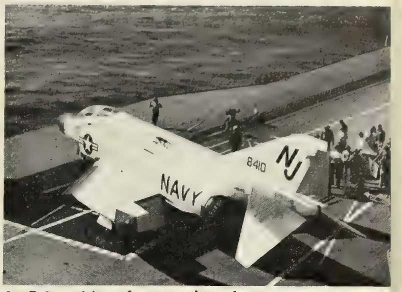
Tucked against the side of the narrow control island, one plane, fuel state too low for another circuit, is serviced with JP-5. From behind, yellow fires can be seen flickering up in the twin tailpipes. This they call hot fueling. Routine.

Nobody walks on the flight deck. Sweatered handlers, all wearing sound deadening ear muffs, dash out whenever and wherever needed. Sometimes one, sometimes two or three — they are always ready, when and where needed. It is soon obvious that they know where they are going, what they are doing and how to do it. Thirty, maybe forty, were the most ever seen on a single job. During a brief respite from flight operations they put on a race against time to drag out, attach and erect the huge barrier that sometimes must be used to catch a damaged plane. This job—one requiring a lot of muscle—took two minutes and forty seconds. Fast as they were, you get the impression they might even shave seconds if there were a cripple inbound, low fuel state.

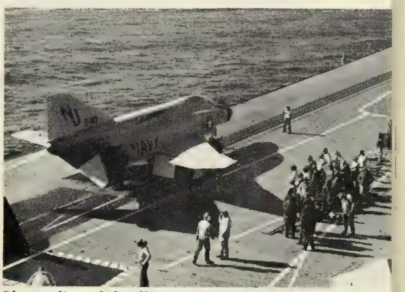
They have to run. Jets gobble fuel rapidly at low altitude, especially in high drag configurations, and there are lots of Navy pilots who need landings to remain current. Pick one up as he rolls into the groove. He's at 500 feet in the pattern and as he starts down he calls "ball" when he picks up the meatball of the mirror landing system. Now he concentrates on line up (not too simple really as the deck is canted and the runway keeps sliding off to the right as the carrier steams straight ahead). The trick is to slide over just a hair to the right to offset. In the groove the pilot concentrates on three things—line up, the meatball and his angle of attack indicator. Fortunately all three are arranged in a straight vision field. At 130 knots indicated and with a maximum of 120 feet of touchdown distance in which to catch a wire there are no split seconds for head or eye movements to sort out indicators. If no waveoff, and these are given both via radio from the LSO and with flashing red lights surrounding the meatball, the three and one-half degree approach ends in a strut mashing impact with the deck. Immediately the pilot slams the throttle to military power. If the hook doesn't catch he has flying speed at or before the end of the "runway." If the hook catches he will be hauled to a shuddering stop in 300 feet. There isn't even time for thankful prayer. He raises his hook, gets the all clear signal from one handler, is passed to the next for a right-turn come-on signal, then, on from one man to the next until he has stopped behind the blast fence waiting for the plane ahead to be catapulted off. He's got to get off the landing area, there may be another plane as close as 20 seconds behind.

And they do this at night too, working in the eerie glow of soft red floodlights. They spread the landing interval to about one minute, but not a single person makes light of the hazard of night ops. This is like the bull riding event in rodeo. It takes a lot of people with a lot of know how and no let-up in concentration to do this without accident.

When you've seen this, take one of the hundred or so near vertical stairs they call ladders and heel-walk your way down to the hangar deck. Here you discover what is meant by the crunch problem. Airplanes, wings folded and tails scant inches from the ceiling, are jammed together tight enough to make a veteran parking lot operator shudder.



An F-4 positions for a cat launch.



Plane aligned, bridle is attached.

On the go-around, after wave-off.

Climbout after a missed approach.

CARQUALS

continued

Throughout this maze are tie down chains. Only the careful can avoid tripping over one of these and at the same time avoid a skull cracking against a stabilator, a flap, or a wing.

Now, for a deeper look at safety in such an environment?

First of all, the operation is recognized as a hazardous one. No one can forget, even for a moment, that danger lurks all around. Prevention of accidents must be a concern of each and every man. Absolute discipline is basic to the accident prevention philosophy. No one on the flight deck during air operations unless his job requires that he be there. The Air Boss (Air Operations Officer perched in the PRIFLY Tower) has absolute charge of all activities on the flight deck and in the pattern—everything he can see. The LSO's word is law. When he says "wave off" it means military power and go, now! The instructions of the signalman directing taxiing of a plane must be followed explicitly. A pilot on the cat, at 100 per cent, never cuts power until he has ascertained that the cat will not be fired. The captain concerns himself with running the ship and continuously must make certain that this is done in a safe manner. He has no restricted seaspace, and must avoid collisions with any huge passenger liner or little fishing boat that might be heading his way.

There's a saying that the sea is unforgiving—this includes the "little" mistakes. The story is told of a tug driver who inadvertently selected reverse instead of low and was crushed under an F-4. Deck men are taught to lie flat and grab anything should they find themselves being blown toward the side. Safety netting has been strung around and just below the edges of the deck as a last resort measure. The LSO has a canvas padded hole he can dive into at the last moment. Squat, heavy tugs are parked along the starboard foul line; they make for tighter taxiing, but offer some protection for the men who must work around the cats and the forward elevator. Wires can snap, wheels can come off, control can be lost. And for contingencies when prevention fails there are other procedures. Man Overboard drills are conducted regularly. During day ops a chopper hovers nearby and a destroyer holds position 2000 yards astern. During night ops there are two destroyers, and all aircraft use Carrier Controlled Approach (CCA), the ships' GCA.

Complacency occasionally creeps in, but not often. All hands know that, even at best, there are things that can go wrong with no warning. A wire can break and whip back, under tremendous tension. A nugget (novice) can get vertigo on a night launch and fly into the ocean. Barked shins and bandaged foreheads identify those who forget when hurrying through passageway hatches. There's always danger of being sucked into an intake, although this has not proven as dangerous as working around spinning props.

As to the F-4, the pilots who fly it are sold. Naturally it has the stressed gear necessary for the high sink rate (1200-1400 fpm) landings, a comforting safety margin for normal runway use. Tires are inflated to 450 psi for shipboard operations and stand the strain of design max gross landing weights of 35,000 pounds. Single engine performance is excellent and poses no problem, according to the pilots, although in training operations such as CARQUALS, loss of an engine, or any other emergency, is cause for bingoing the bird to an alternate on the beach. The aircraft has excellent low speed handling characteristics and engine response. On bolters military power is ample to put the bird back in the air before it reaches the end of the deck. Circuits are flown with gear down and full flaps as power reserve and response are adequate to fly out of any trouble. Visibility is excellent and instruments well located for pilot readability.

For those of us used to operating off Air Force installations with a thousand foot touchdown margin vs. 120; with acres of parking space and all kinds of taxi clearance, not inches . . . there comes a new understanding of how inexcusable it is to land short, or have a taxi accident.

But neither words, nor pictures, nor watching this special closed circuit TV program, nor even watching it live, provides a complete feel of this operation. To really appreciate it, ride through an eyeball bulging, harness straining deceleration from over 100 knots to full stop in 300 feet. This will sell you on safety belts and shoulder harnesses. And if this isn't the clincher, get pasted against the back of your seat as your jet is hurtled from dead still to flying speed in 180 feet. You can't seem to prepare for it, or get used to it, but as the flying safety officer explains, "It's comforting, when you get a wallop like that you know you are going to be flying when you go off the end."

All in all it's an exciting operation. There can be no denying the presence of hazards. It's true that a moment's carelessness can spell ACCIDENT. However, exacting as CARQUALS are, the Navy is proving they can be accomplished safely, by men who know their jobs.

Major T. J. Slaybaugh

REX RILEY'S CROSS COUNTRY NOTES

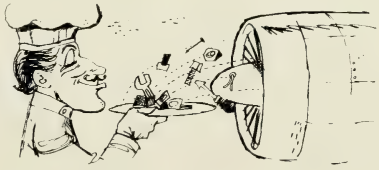
COULD ANYTHING ELSE BE WRONG? Want to hear one where everything went wrong? Tune in on this: After a double flameout the pilot was unable to get an airstart because he forgot to turn the battery switch ON. He had failed to check the battery switch ON during prestart which resulted in complete electrical failure with both engines flamed out. He failed to check the boost pumps ON prior to takeoff. The engines flamed out at 19,000 feet with boost pumps off but the Dash One says this should not happen below 30,000. The pilot failed to properly use his checklist. Supervisors failed to adequately stress use of the checklist. Proper sequence of connecting external power was not followed. Pilot was rushed due to change in aircraft and replacing of a main gear tire. Pilot put his flashlight in the map case where it was not immediately accessible in flight or after bailout. The condensed checklist does not contain immediate action procedure for double flameouts. The crashed aircraft was subjected to fire and explosion due to inadvertent activation of the rear seat rocket catapult by unknown civilian onlookers prior to arrival of military authorities. Pilot's mask was torn off during ejection. The night mission was flown with an inoperative left wing position light. The pilot received a leg injury upon landing due to his inability to judge height above the ground.

THUNDERCHIEF MEETS MURPHY—Recently, a TWX came across Rex's desk stating that all drag chutes on a flight of six '105s failed to deploy. The results were somewhat chaotic. Three of the birds landed at one base where the following happened: One took the barrier on the right hand runway; one blew both tires on the left runway, the third managed to land and stop on R, which had been cleared of the first aircraft.

The other three diverted to another base where all were on the runway at the same time. One took the barrier, the man behind him managed to land and stop in time. The last one in steered around the other two aircraft and went off the end of the runway. He hit some light stanchions and a bulldozer. The bird was well bent but the pilot got out okay.

The drag chute hasn't been a big problem with the F-105, but when Murphy really puts his mind to it, anything can happen. This accident occurred after the six drag chutes were incorrectly installed by personnel at a transient base. Visiting pilots should check installation of drag chutes at transient bases to insure they're properly in place. Rex suggests all maintenance types who ever have to install an F-105 drag chute take a good look at "Thunderchief and the Drag Chute" in the June issue of Aerospace Maintenance magazine. The story has the ungarbled word on the '105 drag chute, its installation and care.

Pilots too would benefit from the article so Rex recommends you jocks dig up a copy of the mag and read the article.

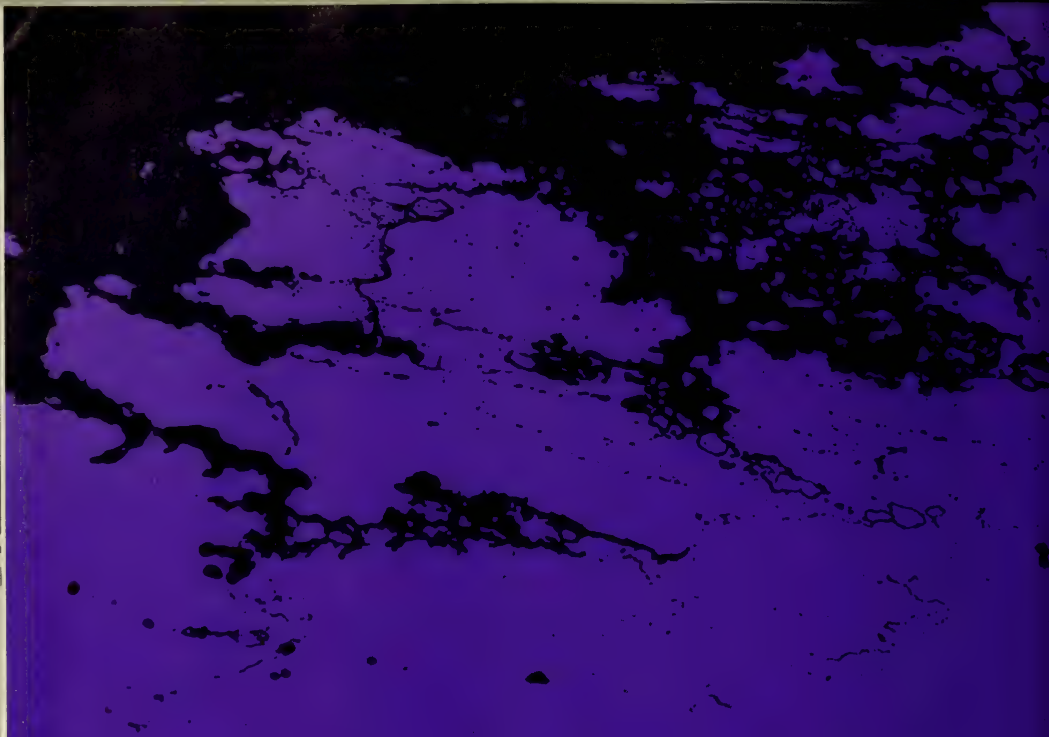


COSTLY DIET FOR ENGINES—Seems Rex has been reading a lot lately about people and equipment being ingested into jet engines. A while back an airman got too close to an intake and the engine grabbed and gobbled up his headphones. This, of course, meant an engine change.

Then at about the same time, a crew chief placed a ladder up to the cockpit of an F-102 that the pilot was shutting down. The crew chief had a canopy jack in his hand with a streamer attached. Well, he missed the streamer and found it and the wire that connected it to the jack in the engine compressor section. Another engine off to the depot for repair!

These are costly mishaps that can and should be avoided, but even more serious are those in which people are the FOD. For example, a crew was performing an engine trim on a deuce when one of the men was pulled into the engine which was going at full mil. The man received multiple injuries but at last report was expected to live.

Rex knows these accidents don't have to happen. He also knows a long lecture probably isn't going to do any good. All he can say is that a little heads-up attention on the part of both workers and supervisors will prevent these mishaps and save some lives and dollars.



CORROSION

WHAT IT IS AND WHAT CAN BE DONE ABOUT IT

Lt Col Reuben B. Moody and Maj George P. Haviland
Directorate of Aerospace Safety

The subject of corrosion has been given some extensive treatment within the Air Force lately. There have been conferences, symposia, technical meetings, surveys and studies, all devoted toward a better understanding of the problem.

Is it really worth all this attention? You will have to judge for yourself.

The Missile Safety Division recently completed a study of in-silo missile system corrosion (Study Nr 41-63, January 1964). During the conduct of the study, many missile sites were visited and the problems were discussed with the people concerned. In addition, some good examples of real live corrosion were observed. Out of this effort emerged two very clear conclusions.

First, corrosion by its very nature is insidious. It quietly eats away at the functional efficiency of our systems. The hazards it creates are sometimes hidden until it is too late.

Secondly, the problem of corrosion is all encompassing. It's big. In fact, if a comprehensive corrosion report were prepared, it would probably look like all the Los Angeles phone books stacked one on the other. So, all this emphasis on corrosion is well directed.

Look at the problem this way: Corrosion can attack every nut, bolt, flange, tube, etc., all the way up to the fantastically large number of individual pieces of hardware which make up the system. Next, there are about ten types or forms of corrosion depending on how they are defined. Now multiply the number of things which can corrode by the number of ways corrosion can work and you have an idea of the size of the problem.

Of course, this approach is an over-simplification. Not all items are prone to all forms of corrosion, nor does this method allow for the time factors involved.

For example, many items in our system can accept a substantial amount of corrosion without any degradation in performance. Items such as large supporting structures, stairways, work platforms, fall in this group. After a while they may not look very good, but there is no need to rush into a frantic corrosion control program.

On the other hand, items such as oxidizer or fuel valves, umbilical disconnects, etc., are items which require immediate attention when corrosion starts.

The point here is that despite the magnitude of the over-all problem, a logical approach based on priorities can help avoid serious corrosion troubles. During the study it was found that the idea of priority lists for the corrosion control effort was not always understood.

The people who battle corrosion on the hand-to-hand basis did understand the need for priority listings but those who were somewhat removed from the chipping and painting didn't get the point. In some cases what was really beautification was being called corrosion control.

Several times the following question came up during the discussions:

If a complex is maintained "battleship clean," nicely painted from top to bottom, structural beams, stairways and work platforms included, is this corrosion control or beautification?

The answer is both. Unfortunately this is expensive in terms of manpower and time. It is much more expensive than a direct approach to controlling corrosion on a selective basis.

During the study, it was found that some organizations concentrated corrosion prevention where it belonged and ignored the work stands and structural beams. This does not mean that such items should be permitted to rust away. But when something is painted for looks, it doesn't necessarily follow that anti-corrosion techniques and materials are used.

The study also showed that corrosion in missile systems has been the cause of numerous component failures and has created several hazardous situations. A listing of these causes by system is contained in the study.

All this indicates the need for an "across-the-board" approach to corrosion. This means that the prevention of corrosion should be emphasized during all phases of system design, development, test, check-out and operation.

For example, the designer should call for compatible materials and anti-corrosion coatings. It must be admitted however, that if the designer has the option of using a new high strength light weight alloy with unknown corrosion characteristics, or an average strength steel with good corrosion resistance, he will probably use the new alloy.

The development agency should check all areas of the over-all system which could be corrosion-prone. Interfaces between equipments made by different contractors should be analyzed for corrosion susceptibility. All of these efforts are important but it is during the installation and check-out phase that the corrosion prevention techniques came to fruition. Despite good design, items can have the protective coating damaged during installation which permits corrosion to start immediately.

The study noted one case where a major item of equipment was delivered to the site, left exposed to the elements and then along with a nice coat of rust, installed in the hole. A coat of paint was hurriedly applied and the corrosion problem became the property of the user. Obviously, the rust should have been removed prior to painting.

The idea of corrosion prevention measures covering all phases of system design, test, etc., is not new. We have adequate coverage in specifications, work statements and other documents. But the press of time, acceptance tests and turn over dates bring sites into the inventory which are already behind schedule in corrosion control. The solution to this problem is difficult since it involves many factors and compromises. However, it is likely that closer control over the techniques used during installation would help to some extent.

Before covering the various forms of corrosion, one additional point disclosed by the study deserves some attention. The subject concerns corrosion control equipment. Power tools are necessary to speed up the removal of corrosion and its by-products. Hand tools simply will not do the job on a continuing basis. Special equipments which can provide access to the out-of-the-way sections inside the complex are needed.

Thus far, some of the findings resulting from the study have been discussed. It has been necessary to use the word "corrosion" rather frequently but as yet no attempt has been made to describe its many

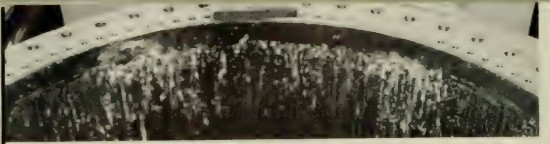


Fig. I. Uniform Corrosion

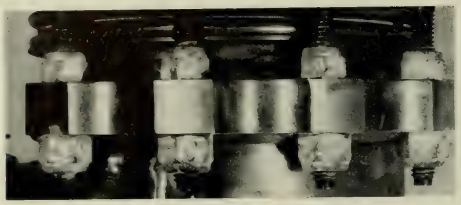


Fig. II. Dissimilar Metal Corrosion

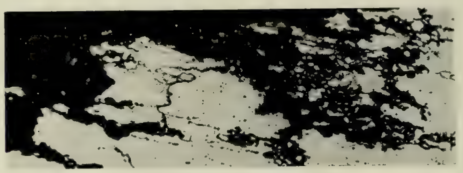


Fig. III. Intergranular Corrosion

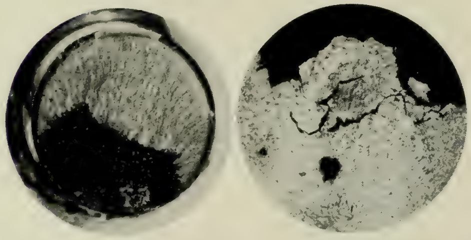
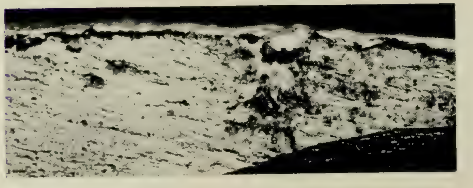


Fig. IV. Fig. V.
Examples of Stress Corrosion

Fig. VI. Pitting Corrosion



forms. Following is a brief description of the various types of corrosion, using photographs where possible and summarizing the information into a table for quick reference.

Uniform Corrosion: This is the most common form of corrosion. It is a general attack on the metallic surface. Designers can provide more metal to give the desired life but in missile systems this is not always possible. For example, the photograph (Nr 1) shows general corrosion of the recirculating tubes caused by condensation—evaporation cycling.

Galvanic Corrosion: This is a complete class of corrosion types involving electrochemical action between two metals or between different areas of the same metal having different heat treatments or other metallurgical differences.

Dissimilar Metal Corrosion: This type of corrosion is a subgroup under the general class of galvanic corrosion. Here the electro-chemical reaction is caused by two different metals in contact with an electrolyte. The electrolyte in most cases is water. Ordinary tap water contains a sufficient quantity of dissolved chemicals to make it moderately conductive. Dissimilar metal corrosion is almost always localized to one or the other of the metals involved. Photograph Nr 2 clearly shows the corrosion on the aluminum nuts used to secure the stainless steel flange. To explain why only the aluminum corrodes, it is necessary to show the following table:

Corroded End of List (Least Noble — 1)

1. Magnesium
2. Aluminum
3. Manganese
4. Zinc
5. Chromium
6. Iron
7. Cadmium
8. Nickel
9. Tin
10. Lead
11. Copper
12. Silver
13. Platinum
14. Gold

Protected End of List (Most Noble — 14)

If two metals are placed in contact in the presence of an electrolyte, the metal nearer the top of this list will corrode. The farther apart the two metals are, the more aggressive will be the corrosion.

Intergranular Corrosion: This type of corrosion is also a form of galvanic action where the metallic grain boundaries and the grain particle creates a cell in an ambient corrosive solution or atmosphere. Intergranular corrosion is a particularly bad form of corrosion because it attacks the basic grain boundary structure of the metal. Photograph Nr 3 is a striking example of intergranular corrosion of an aluminum alloy.

Some of the stainless steels are prone to this form of corrosion if they are heated. This could occur during welding. The heating causes chromium carbides to collect at the grain boundaries and the corrosion begins.

Stress Corrosion: This type of corrosion is caused by the interaction of a corrosive attack and sustained tension stress. Cracking of the surface is usually present. Stress corrosion is intergranular corrosion but with tension loads either from "locked in" stresses or externally applied forces. Photograph Nr 4 shows an end view of a bolt which failed as a result of stress corrosion. The corroded area is shown as the darker section. The remaining metal then failed from overstress. Photograph Nr 5 shows a micrograph of the same bolt looking across the fracture surface. The intergranular cracking is clearly shown.

Pitting Corrosion: This is a localized form of corrosion in which a break in the passive film occurs. Once broken, a cell is formed between the exposed metal and the passive metal. Such breakdowns in the protective coating can occur at a rough spot, machining mark, scratch or other surface flaw. Pitting corrosion can also occur under a small deposit (weld spatter or dirt particle) which prevents the access of oxygen to the metal. Pitting corrosion proceeds at a rapid rate if the products of corrosion are conductive. Photograph

Nr 6 is an example of such corrosion showing the depth and local characteristics of the pit.

Erosion Corrosion: In this case, the corrosion products are removed by the action of fluid flow or pressures, thus exposing fresh metal to the corrosion attack. The progress of this type of corrosion is very rapid.

Concentration Cell: A form of galvanic corrosion wherein dissimilar electrolytes are in contact with a metal. Not as prevalent as the preceding types of corrosion, it nonetheless is important. For example, corrosion of underground piping in contract with soil of different compositions is a form of concentration cell corrosion.

The following table summarizes the various forms of corrosion discussed and offers some general guidance on reducing the extent of the corrosion.

In practice, T.O. 1-1-2 provides an excellent reference regarding the details of corrosion control and treatment.

Type	*Description*	*Precaution*
Uniform	1. A general attack on unprotected surface. 2. Combined effects of moisture, temperature, condensation and evaporation. 3. Also caused by direct chemical attack.	1. Overdesign structure to accept corrosion. 2. Remove with chemicals or abrasive techniques and apply protective coating. 3. Isolate metal from corrosive environment.
Galvanic	1. Electrochemical corrosion cells are formed. 2. An electrolyte in contact with two different metals or one metal having different characteristics.	1. Avoid dissimilar metals. 2. Use coatings and/or cathodic protection. 3. Place a dielectric barrier between the dissimilar metals. 4. Interrupt the electron flow through the electrolyte.
Inter-granular	1. Galvanic cell between grain boundaries (positive) and grain center (negative). 2. Destroys structural bonding of the metal grain.	1. Different heat treatment, annealing or new metallurgical design. 2. Use stabilized stainless steels or low carbon steels.
Stress	1. Combined effects of tensile stress and corrosive environment. 2. Tensile stresses expose metal to the corrodent.	1. Reduce stress level. 2. Use shot-peening or annealing to reduce the residual stresses. (Shot-peening forms a layer of compressive stress on the surface.) 3. Alter the corrosive environment.
Pitting	1. Incomplete protective film or coating. 2. Particles deposited on metal surface break down the film by creating an oxygen deficient area.	1. Any metallic coating which is anodic to the base metal, i.e., zinc coating on steel. 2. Organic coatings such as paint, asphalt, vinyls, epoxys or rubber.
Erosion-Corrosion	1. Corrosion products are removed by erosion, thereby exposing fresh metal to the corrodent.	1. Sacrificial, non-metallic coatings. 2. Better design, more metal where it is needed. Use metals which have high resistance to corrosion.
Concentration Cell	1. Dissimilar electrolytes in contact with the metal. This includes differences in acidic content or oxygen concentration.	1. Coatings, cathodic protection and corrosion inhibitors. 2. Removal of electrolytes.

In conclusion, here are nine methods, depending on the problem, which can be used to control corrosion. The first eight do not all apply to any one case. The last one applies everywhere, all the time.

1. Use materials which are compatible with the liquids and gases with which they will come in contact.
2. Use inhibitors which will form a protective film as the corrosive material comes in contact with the metal.
3. Use coatings such as paint, which do not permit corrosion cells to form since they prevent the completion of the electric path.
4. Use protective materials such as galvanizing or anodizing over the metal.
5. Use counter current electrical flow to oppose the current generated in the corrosion cells.
6. Use environmental controls. Air conditioning processes are sometimes used to remove moisture from the air which might otherwise condense on metallic surfaces and start corrosion cells.
7. Use similar metals whenever possible.
8. Use sacrificial anodes, i.e., more active metals than the metal to be protected. The more active metal will corrode, protecting the critical structure.
9. *Use common sense.* ☆

MISSILE SAFETY AWARDS

Outstanding safety records have earned Missile Safety Awards for the following Air Force organizations. The awards are for performance from 1 January to 31 December 1963.

AAC	• 5010 Air Base Wing, APO 937, Seattle, Washington
ADC	• 35 Air Defense Missile Squadron, Niagara Falls Municipal Aprt, New York
	• 1 Fighter Wing, Selfridge AFB, Michigan
AFSC	• 6595 Aerospace Test Wing, Vandenberg AFB, California
SAC	• 556 Strategic Missile Squadron, Plattsburgh AFB, New York
	• 17 Bombardment Wing, Wright-Patterson AFB, Ohio
TAC	• 27 Tactical Fighter Wing, Cannon AFB, New Mexico
	• 4520 Combat Crew Training Wing, Nellis AFB, Nevada
USAFE	• 38 Tactical Missile Wing, APO 130, New York, New York
	• 65 Air Division, APO 283, New York, New York
PACAF	• 39 Air Division, APO 919, San Francisco, California
	• 18 Tactical Fighter Wing, APO 239, San Francisco, California
ANG	• 141 Fighter Group, Spokane International Airport, Washington

MISSILANEA

COMMANDER'S GUIDE—A neat little package is going out into the field via the Missile Safety Officers' Special Study Kit. It's called "Commander's Guide to Missile Safety" and was put together by the Missile Safety Division of the Directorate of Aerospace Safety, DTIG.

The guide is printed on hard paper in seven colors and contains a very brief text and a checklist in the following subjects: Responsibilities, Mishap Prevention, Command and Supervision, Operations, Training, Maintenance, Facilities, Support, Mishap Investigation and Reporting, Mishap Analysis, Missile Safety Surveys, Command Support-USAF, and a list of publications.

The whole works is stapled together in a booklet measuring 4½ x 8½ inches, and it makes a compact, handy reference tool to help commanders and safety people run their programs.

FIRST AID—CHEMICALS. Safety considerations dictate knowledge of first aid procedures for those who work around chemicals. When specific instructions are not immediately available, common sense application of basic first aid rules is recommended.

Vapor or Mist Inhalation: Immediately remove the victim from the contaminated atmosphere. Call medical personnel at once.

Skin Contact: Flush the affected area(s) immediately with water for at least 15 minutes. Remove contaminated clothing. Call medical personnel at once. Wash all contaminated clothing before re-use.

Eye Contact: Do not rub! Irrigate immediately with water for at least 15 minutes, holding lids apart to ensure water contact with all eye and lid tissue surfaces. If necessary to choose between irrigation and contacting medical aid, irrigate for 10 minutes, call medical personnel and resume irrigation.

(Martin-Denver Safety Publications)

ROUTE PROTECTION. A government auto returning from a missile site with three passengers was struck by a train. The driver and two passengers were seriously injured and a fourth man killed. An alternate route was being used which led through a small community and across the railroad tracks. The only warning was the familiar crossarm warning sign. Granted that the sign should have been sufficient, the driver apparently was preoccupied with keeping his vehicle under control on a gravel road covered with snow. The road was slick and the crossing one of those "blind" ones that invites disaster.

The collision resulted in all of the occupants of the car being thrown out. Since the cab was almost intact it was felt that had they been wearing seat belts their injuries would not have been as severe and the deceased would have survived.

This accident points up the necessity for some careful attention as to the routes from base to missile sites. These roads are of all grades and cover almost every conceivable type of terrain. Pick a hazard to driving and you can bet that drivers on some of these roads will encounter it. This calls for a careful survey of all routes to the sites that will be used by Air Force vehicles. Each hazard should be catalogued and action taken to either remove, or warn drivers of, the hazard. Route maps should identify these hazards and drivers should be briefed prior to making a trip.

Another factor to be considered is the condition of the men driving to and from the sites. They may have been working hard all day or night; they may have been on duty for more than 24 hours; they may have to drive many miles in a very tired and drowsy condition.

The conditions may not make accidents inevitable but do increase the possibility. Anticipation of these hazards and contributing factors is necessary to prevent accidents and possible deaths. ☆

DECLARING AND CONDUCTIN

Last year Air Training Command experienced thousands of inflight emergencies. Remarkably, only a few of these events involved accidents. The fact that only a very small percentage of these potentially dangerous situations resulted in accidents was due entirely to the pilots' conduct of the emergencies. In the overwhelming majority of the cases pilot analysis, judgment, and action during the emergency was highly praise-worthy and, in several outstanding instances, deserving of official recognition. However, in a few isolated cases, the safety margin was reduced by the pilots' needlessly compromising good flying safety practices.

The term "good flying safety practices" is a generality used intentionally which permits us to express our attitude toward the safety features of operating procedures without the necessity of being specific. This broad phrase is necessary for this article as the diversity of aircraft and missions throughout Air Training Command does not permit us to pinpoint the best actions for individual cases. However, there are areas we can examine which will imply the proper pilot response to any emergency. The detailed actions the pilots then take should be dictated by these responses and by pertinent aircraft operating procedures and limitations. We can examine these areas by asking these questions:

- Why do we declare emergencies?
- What circumstances do we consider emergencies?
- When should the pilot declare an emergency?
- What actions should a pilot take during an emergency?

First, why do we declare emergencies? Obviously, to obtain assistance in eliminating the problem, or to prevent the problem from mushrooming into greater or unmanageable proportions. For example, the pilot may require advice from operations or maintenance in order to extend a malfunctioning landing gear, or to have foam sprayed on the runway to prevent a belly-landing from resulting in a burned aircraft and seriously injured crew. In either case, the pilot is requesting others to help provide a safety margin greater than he can provide alone. Further, by declaring the emergency, the pilot is alerting ground agencies and other airborne aircraft that he is demanding priority use of all control and landing facilities. This notice will permit operations and traffic control agencies to begin immediate planning for the safe and orderly control and recovery of other aircraft should the emergency interrupt scheduled use of the runways. Only rarely can the pilot expect outside aid in the immediate areas of aircraft control and pilot judgment, but the way to a safe full-stop emergency landing can be well-greased in advance by in-position crash units, alerted control towers, and GCA units. First, though, we have to tell them we need their assistance. No one has been turned down yet!

Next, what circumstances constitute emergencies? A quick answer to this question is those circumstances which threaten loss, damage, or destruction of property, or loss of life or injury to personnel. The threat may be immediate, as in loss of an engine at low altitude; or distant, as in the case of unexpected fuel-consuming headwinds on a high-altitude navigation mission. More specifically, we can say that those conditions requiring the use of the emergency procedures listed in the Dash One justify a declaration of an emergency. This, though, is only a partial answer. To be more complete we have to add those situations not covered by an emergency procedure. Those that require considerable pilot effort and skill to rectify, such as many of those cases which received the Air Force "Well Done" award. In fact, to use another generality, we should treat as emergencies all circumstances which tend to make further flight unsafe—whether the threat is real or only suspected. Sound pilot analysis and judgment must rule in this grey area. Consider the old saw, "There are old pilots, and there are bold pilots, but there are no old, bold pilots." It's true there are no old, bold pilots, but our ranks are swollen with old, suspicious, cool, calculating, cautious pilots who have a fine record of mission accomplishment and a spotless flying safety record.

This leads us to our next question: When should the pilot declare the emergency he has encountered? This is the easiest of all to answer—as soon as he has determined he has an emergency on his hands. The sooner, the better. The safety factor with which we begin a flight is reduced at the onset of the emergency and shrinks further with the passage of time. We can't patch the safety envelope but we can insure ourselves of greater freedom to cope with the emergency by alerting others of our difficulties and intentions. Chaos, compounded by disorder, surprise, confusion, and ex-

MERGENCIES

Capt Guy L. Palumbo, 3510 Flying Training Wing, Randolph AFB, Tex

citement can easily be the result of a pilot's initial radio call that he is at high-key with a dead engine, or on a short final with an unsafe gear. Given the choice, commanders would far rather tolerate repeated mission interruptions by long-notice emergencies than explain a single aircraft which burned on the runway because the crash units were not alerted. We have nothing to gain by delaying our emergency calls, and quite a bit to lose.

During a recent ten-year period the Air Force lost 3500 pilots through accidents. Many of these deaths were caused because the pilots declared their emergencies too late for crash and rescue units to be of any assistance. There is no conceivable instance whereby we benefit from aggravating an already potentially dangerous situation by delaying a declaration of emergency. When confronted with an emergency, report it immediately. The accident you prevent may be your own.

What, then, do we do about the emergency? This answer, too, is simple but can lead to many courses of action and develop ramifications that can't be pursued in this article. However, the two general courses of action that are open in all emergencies are to either cure the condition, or contain it until a safe landing is made. All our emergency procedures are geared to these two ideas, thus the heavy need to thoroughly understand all the operating procedures of the aircraft we fly. Rote is required for all critical items in an attempt to insure the proper pilot response to well-defined situations. But it is not enough to memorize, we must also analyze. It has never been intended that the pilot in all cases blindly follow the step-by-step procedures for an emergency, hoping his automated actions will, somehow, provide the proper response to the problem. Rather, the memorization concept is based on the possibility time may be so critical, or our mental processes so disrupted, we must rely solely on our memory-conditioned reflexes to guide us. But rarely, except in the most sudden, critical emergencies, is there not some time for reflection and analysis, no matter how brief. Individual pilot proficiency and experience will determine whether or not the time margin will allow more calculated response to the emergency. Time permitting, the checklist should be used for all emergency procedures, including the critical action portions, as directed by AFR 60-9. This requirement does not preclude other courses of action should the pilot's analysis and judgment indicate he should modify or even discard the recommended procedures. Our Flight Manuals specifically caution us in this respect, stating in effect, "Instructions in this manual are for a pilot inexperienced in the operation of this aircraft. This manual provides the best possible operating instructions under most circumstances, *but it is a poor substitute for sound judgment.* Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures" (emphasis added). This is not a license to steal. It's merely a reminder that all adverse circumstances cannot be anticipated and defined for programmed action, that the final responsibility for the conduct of all flight operations rests upon the pilot. Neither is it a directive for the pilot to attempt to prevent the accident at all costs. In no case is the crew to be jeopardized for the sake of the aircraft. We can't argue with success, according to a popular adage. However, success in handling an emergency is predicated not on the ultimate recovery, but on the *safe* recovery of the crew and aircraft.

Though the mission requirements command our greatest attention, a safety-in-flight theme is interwoven with operating needs in all our flying activities. This safety theme is the predominant concern during emergencies. Command and operating elements must necessarily accept those risks inherent in flying but once the mission has been aborted by an emergency, safe conduct of the emergency must receive first consideration. ☆

EMERGENCY WELL HANDLED

Recently, student pilot 2d Lt John M. Johnson, Jr., was flying a T-38 at 42,000 feet when both engines flamed out. Lt Johnson was about 60 miles from Williams AFB at the time.

Rather than leave the aircraft immediately, he turned toward base and tried an airstart without success. "Everything my instructors had said to me, and all the emergency procedures checklists they had made me memorize in the past year, suddenly came through very clearly," Lt Johnson remembers. "Considering the amount of control I had over the aircraft, speed, weather conditions, my direction and distance from the base, I decided to ride it out."

The aircraft entered clouds at 34,000 feet and without power the only attitude instruments available were the pitot static group and the turn needle. With the turn needle he was able to keep the wings level. Then the canopy began icing up. Lt Johnson decided that if he did not have an airstart he would eject at 10,000 feet.

Fortunately, at 16,000 he got the left mill going and the other one eventually started at 4000 feet. During turn to final the right engine flamed out again but Lt Johnson continued and made a single engine landing. ☆

PROBLEM OF A

MORGUE STATISTICIAN

I'm a morgue statistician. I'll explain, since neither title nor job description has ever been listed in Air Force pubs. I tabulate the Air Force's ground injuries and fatalities, and record a brief of the cause. It's not difficult, really. I might describe it as very simple accounting. All I have to do is list the fatalities in one column, the major injuries in another column and the minor injuries in a third. Sometimes I have to make corrections, like when a major injury dies I have to add to the fatalities. Of course I have to deduct one from the major injuries when I do this to keep my records in balance.

At first I didn't know if I could last in this mortuary management specialty. But I was talked into giving it a good try because much of the effort to reduce the fatals, the majors and the minors would be based on accurate actuarial statistics I would record. However, as a statistician, I soon realized that there was no apparent progress being made. Occasionally one category or another would change, but the totals in the fatals, majors and minors held steady, showed slight increases, actually. Finally, in order to forget the job after 1630 I took to thinking only of numbers. I refused to visualize a fatality as a nice-looking young airman in a blue suit, or a major as his 20 year old buddy rolling his way down a hospital corridor because his legs were permanently paralyzed. I even got so that if I saw an airman limping, or using a crutch, or with a leg in a cast, I looked the other way. I made it a point to disassociate such indications with my minors.

That is, I tried to. I was never fully successful because of the brief narrative descriptions that they insist I write for each number I add to the fatal columns.

Just to give you an idea, here are some that I had to write the day before and the day after a holiday (holidays are my most difficult times).

Fatal—Airman was passenger in POV that went into a curve at high speed, left the road and struck a light pole, skidded and hit a second pole broadside. Subject thrown 160 feet by impact. Driver had been drinking.

2 Fatal—Both airmen were in POV and had passed a vehicle when their car went into a skid, was struck by oncoming car. Both subjects were thrown from car. Driver unknown.

2 Fatal—Both airmen in POV which failed to make a turn and crashed into a canal. Driver unknown.

1 Fatal—Airman working on engine of his auto when a blade came off the fan and hit him in the head.

1 Fatal—Officer and family in POV on icy road when involved in a head-on collision.

2 Fatal—Airmen were in POV which struck center fence dividing a freeway, spun, struck another vehicle, spun again striking and killing a motorcycle patrolman. Both subjects thrown from vehicle.

1 Fatal—Officer was driving his sports car when he failed to make curve. Speed at time of accident estimated by highway patrol at 120 mph.

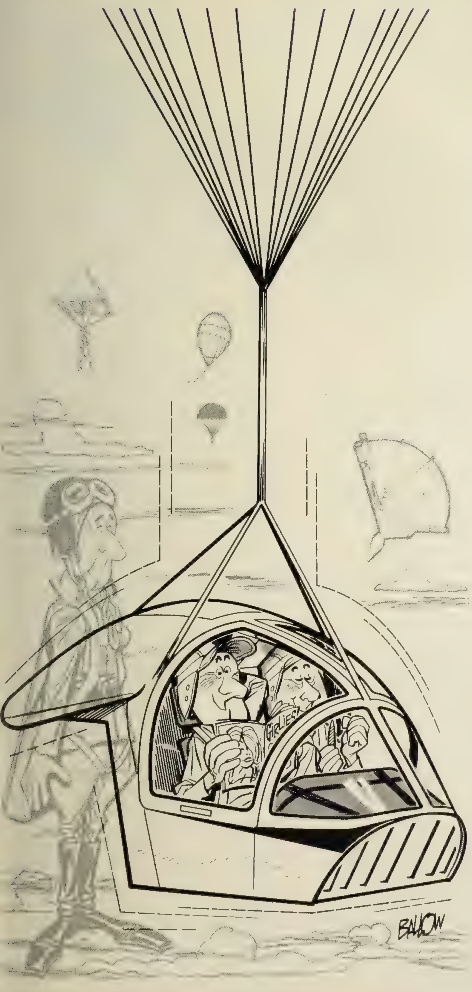
1 Fatal—Airman was passenger in POV which went out of control on a curve, sideswiped an oncoming car, and turned over.

1 Fatal—Sergeant was in boat, pulling on anchor rope. Rope broke causing subject to fall into water and boat to capsize.

1 Fatal—Airman discovered in his trailer, dead from asphyxiation caused by a faulty heater.

You know, one thought keeps coming back to me. None of these people figured this could happen to them. I read somewhere that drivers involved in accidents all have one thing in common and that's the attitude that "all is well." Apparently this attitude is almost a prerequisite to getting involved in an accident. If a driver is going to be caught short in accident-causing circumstances, he must not be expecting them. Maybe we need a new safety slogan: If you drive—Worry! ☆

BIRDNEST ON THE GROUND



G. C. Tate, General Dynamics/Fort Worth

TIME WAS, POST ICARUS, when the pilot in trouble could cinch up his goggles, stow his map, grab a guy wire, step over the side, then chute to safety. Later, came such niceties as rocket assists, bottom snappers, automatic timers, lanyarded survival packs, bailout bottles and so on. Before enough mods had been made to these to effect an ejection success of better than four-fifths, along came another innovation : the capsule.

Tried out first on bears, the capsule has been made available for B-58 crews. By pulling a couple of levers they can encase themselves in a metal and plastic cocoon and initiate a sequence that ends up with encapsulated crewmembers drifting down from disabled aircraft.

Now we learn of the crew escape pod (pictured with some degree of artistic license). With the pod—planned for the F-111—the crew compartment separates from the airframe and is lowered to the ground by a recovery parachute. When the proper handles are pulled by the crew, ejection initiators are fired which begin a series of events : the crewmembers inertia reel, the emergency oxygen system, emergency cockpit pressurization and rocket igniter are activated. Then the severance system actuates starting delayed ignition for drag plates, parachute deployment, pod repositioning, landing attenuation system, emergency battery and rescue aid radio. After this, an exploding wire detonates, explosive bolts at main structural attach points separate, controls are decoupled, electrical connections separated, and leading edges of the stabilization flaps are detached from the wing structure by a detonating cord. The escape pod and airframe separate. As the pod falls through 15,000 feet the main recovery chute deploys.

If the landing is on water, the pod floats. It also contains such post landing survival goodies as first aid kits, knives, rations, transceiver, signal mirror, and other standard survival equipment.

The F-111 escape pod has been designed so that the maximum "eyeballs out" load factors and "eyeballs down" load factors are each well within the limits of human tolerance.

The escape system must protect the crewmember from rotational tumbling. Using pitch and roll plates, the F-111 escape pod is designed to be stable from the instant of launch.

During descent, the pod provides windblast protection for it is the same cockpit within which the crew has been flying. The cockpit escape pod protects the crewmembers during descent by providing emergency cabin pressurization, emergency oxygen, and the structural protection of the cockpit from cold and wind blast.

To attenuate the landing shock, an inflatable bag on the forward end of the capsule absorbs shock caused by descent velocities of up to 30 feet per second combined with a 20 knot drift, a 10 degree parachute oscillation, and on a 5 degree slope.

When all this becomes reality, and when everything works as advertised, crewmembers will have a more reliable, safe escape system with their own bird's nest on the ground. ☆

HOW LONG IS A MINUTE?

Listen closely to the second hand on your watch. Count sixty ticks. Seems like a long time, doesn't it?

You are sitting in your bird in takeoff position on the end of the runway. Behind you is an aircraft on final approach. You have been cleared for immediate takeoff. Just then your flashlight slips to the floor and rolls under the right rudder pedal. The next minute SEEMS like an eternity.

Conversely, how long does a minute seem at high station when you have to check the time, adjust power, report, run a checklist, listen to chatter, sort out and react to that which is pertinent and, of course, fly the airplane?

Now for a specific case—the reason for this article. A jock crashed into mountains. He crashed approximately three minutes after he had been told "If no communication is received for one minute while in the pattern or five seconds on final . . ."

No one will ever know, for sure, why he failed to execute lost communication procedures. Without going into all the details and extenuating circumstances as to why a Guard transmission, or any other safeguard, failed to prevent this accident in the three minute interval, let's examine the question, "How long is a minute?"

Surely the minutes, three in this case were not very long. A pilot flying a jet aircraft, near the ground, in weather, in a terminal area while other aircraft are being recovered is in an extremely busy environment. And minutes pass in a hurry.

Regardless of the *apparent* length of a minute in this environment, there is one thing for sure—a jet aircraft covers about three to four linear miles for each minute that passes. These miles may be in a straight line, may be in curving lines as in part of a teardrop—in rare and usually disastrous cases they may be nearly vertical and in one minute a jet can travel three plus vertical miles and end up punching itself a smoking hole.

Before exploring possible aids to flying these last minutes more safely, one more aspect bears consideration—how does the pilot know when to start his timing in order to execute lost communications procedures. Obviously he is too busy to check the second hand on his clock at the end of each communication received, then make a mental note that a minute hence he has to make his move. At best, all he can do is estimate. This brings us right back to the crux of the problem—how long is a minute? How, whether minutes are fleeting or dragging, is he to measure the standard 60 second minute?

At best, he can only estimate. We've already pointed up the difference in apparent length due to pressures—here's a test you can try on others. Have them check the second hands on their watches to pick a starting time, then when they estimate a minute has elasped, have them record the number of seconds in their estimated minutes. Of course they will vary, and, based on limited test data, most test subjects will estimate well short of an actual minute, *particularly* if all they are doing during the time period is waiting until they think their minute is up. Of course, there is no end to the amount or direction speculation can take in a project of this kind—do people with a lot of nervous energy always estimate the duration o a minute to be less than the slowe methodical types?

In any case, there are enough variables to make the safety precaution, "If no communication is received for one minute . . ." a difficult matter to pin down.

What then, if pilots are to be protected in this potentially hazardous environment? Here are some suggestions:

- Know the terrain in the area In some places—Taipei, for in stance—there is high terrain all around, and a pilot who loses communications or becomes disoriented or confused should start an orbital climb until he reaches sufficient altitude to clear obstructions. In many others there are clear quadrants—fly a northeast heading at Lages, a westerly heading at Oxnard, fly west and climb at Norton.

- Make it a point to study maps of the area and the letdown routes. This way a mental image can be kept in mind as to the position of the aircraft in relation to terrain hazards at all times. Then, should loss of communications or disorientation be experienced you immediately know which is the safe way out at any particular point during the approach. At March AFB large maps with SIDs and approaches superimposed are on display for just such a purpose.

Use all the NAVAIDS available. Though the approach may be GCA, if there is an ILS for the same runway always tune it in, identify it, and give it an occasional cross check. If you have both UHF and VHF, have GCA transmit simultaneously on both so that you can switch to a backup if need be. If no ILS is available for the landing runway, crank in the ADF, or VOR or TACAN. Of course, be sure you have the TACAN-VOR selector switch properly positioned. Then pick up the needle occasionally in your cross check. If things don't look right ask, and if doubt exists, take the pre-planned safe way out. This is a lot more reliable than trying to estimate the seconds in the minute that started with the "last communication."

If other chatter stops, particularly if you lose side tone, be suspicious.

Our apologies if, when you started this article, you expected to get the word on the exact length of a minute. But we trust you may have acquired something that may, in actual practice, help you even more in missing a socked-in pile of rocks. Sometimes a reminder of the inadequacy of a safeguard and suggestions on how to combat it may have more accident prevention value than a pat answer to a question such as, "How Long Is A Minute?" ☆

TWX's

ACCIDENTS, INCIDENTS AND ALMOST . . .

▶ FLYING SPEED—Not an Air Force bird, but shows what could happen. On final the pilot's airspeed indicator showed 142 knots and the copilot's 120. The approach was continued, using the copilot's airspeed indicator and normal flare speed. The pitot static systems were drained, checked for condensation and the lines blown out. During the following takeoff roll an abort was made when the copilot's and navigator's airspeed indicators registered zero. A small fly and a piece of leaf were removed when the right pitot static system was dismantled, and the thread on the pitot head angle fittings was found damaged.

▶ ONE OF THE REASONS given as contributory to an aircraft accident (crashed into mountains) was listed as failure of the pilot to monitor Guard channel during a GCA approach. One of the reasons given for his not monitoring Guard on GCA was the probability of transmissions on Guard blocking out pertinent transmissions of the GCA controller. One of the reasons listed as to the reason for the number of transmissions on Guard was the common practice of using this frequency for *NON* emergency traffic.

One of the reasons some cause factors are listed as contributory in accident reports is to identify factors which, had they been recognized and properly acted upon, might have prevented the accident.

▶ SUCKER SADDLES. The flight of two F-102s were just topping the thick cirrus layer at 45,000 feet as they went through the saddle between two thunderstorms. They were indicating Mach .8, 220 knots, and unable to climb any higher. Beyond the saddle they found another thunderstorm, top estimated at 50,000 and couldn't turn without losing airspeed. Ignition buttons were pressed and the aircraft penetrated the storm, on course. In less than one minute severe bangs were felt followed immediately by a flameout. Throttles were not moved until after flameout and there was no increase in EGT. Attempts to catch unwinding engines with ignition depressed were unsuccessful. Ignitions released and emergency fuel selected as RPMs unwound through 45 per cent. Throttles were stopcocked and airstarts were attempted on the emergency fuel systems. Normal fuel was selected and airstarts were accomplished at approximately 25,000.

▶ PEOPLE PROBLEMS. An observer noted something fall from the aircraft as it broke ground on the takeoff roll. The pilot was advised by the tower and requested to return. The base operations duty officer found the right hand crew compartment life raft hatch cover approximately half way down the runway. The life raft remained sealed. The hatch cover apparently struck the right hand HF antenna upon separation since the antenna was torn loose at the forward mast. The life raft had been installed immediately prior to this flight. Installation was not performed in accordance with current maintenance instructions which require that the aricraft be placed on a red cross until installation is inspected by a seven level supervisor. ☆

The question pilots sometimes face is whether to get rid of the canopy or keep it as a protective shell. The author examines this question in . . .

Jet Fighter
CANOPY JETTISON

Capt Donald H. Volz, Sacramento Air Materiel Area, McClellan AFB, Calif

To jettison or not to jettison the canopy? This question has often come to my mind, especially since the time I witnessed an F-100F crash on takeoff. The result was two fatalities after one pilot jettisoned the canopy and ejected when the fuel tanks exploded. Because of the quick action of the crash crew I felt the pilots would have survived had the canopy been retained.

In my present position as Flight Manual Manager for SMAMA's prime aircraft I have had the opportunity to examine this question more closely. Present guidance on this subject instructs pilots to jettison the canopy of the airplane prior to any imminent crash landing to provide for means of immediate escape and to prevent entrapment.

Recent investigations, however, have shown that in many cases it may be more advisable to retain the protection afforded by the canopy. A review of accident records revealed that, in several instances of controlled crash landings which resulted in aircrew fatalities, the crew might have survived had the canopy been retained. (DTIG defines a controlled crash as: One in which the pilot was able to exercise sufficient control so that the plane's initial contact with the terrain was such that the accident was potentially survivable.) In each of these cases, (1) the crash oc-

curred on an airbase, (2) the canopy was jettisoned during or prior to the crash, and (3) the fatal injuries resulted from the ensuing inferno or from flaming fuel splashing into the cockpit.

Two accidents on record show interesting contrasts. One, in which the pilot could not eject or jettison the canopy, was a crash on an airbase with the ensuing "ball of fire." The crash crew was on the scene and extinguished the fire in about one and one-half to two minutes. When the canopy was removed the pilot inside was alive and uninjured, although he was very hot and had lost a great deal of weight. In the other, the crash occurred off base and in some trees. The canopy was retained and, during the crash and slide, flaming fuel scorched the canopy. However the cockpit rode through the flames intact, and the pilot emerged uninjured.

With the assistance of DTIG (Life Sciences Group), it was determined that it is advisable to retain the protection of the canopy when a crash is imminent on an active air installation. For a crash on other than an active air installation the general guidance is to jettison the canopy. However, because of the many factors and possibilities involved, the final decision should be left to the discretion of the pilot. Analysis of this problem, indicates that the following factors and procedures should be considered by all aircrews of jet fighter airplanes:

Accident statistics show that fire occurs in approximately 45 per cent of all controlled crashes.

The post crash fire of a controlled crash is usually not an instantaneous complete engulfment in flames. (Especially if external fuel tanks have been jettisoned.)

If a crash does result in immediate engulfment in flames, however, the absence of the canopy will most certainly result in immediate fatal injuries to the crew.

The heavy plexiglas canopies and pressurized cabins can afford definite, temporary protection from heat and flame.

The possibility of entrapment due to inability to open the canopy or because of position of the aircraft has been shown to be quite remote.

The installation of the canopy break-away tool, becoming standard in many jet fighters, eliminates (to a large degree) the danger of entrapment due to inability to open the canopy.

Most active air bases maintain a fire-fighting unit on runway alert, thereby decreasing the reaction time to an on-base crash.

When the canopy is jettisoned in flight the pilot is subjected to conditions to which he is unaccustomed and this may compound an already tense situation.

If the canopy is jettisoned before the airplane comes to a stop barrier webbing, cables, or wires can enter the cockpit and injure the pilot.

After a crash in which the canopy has been retained the crewmembers should unfasten all personal equipment and leads, *attempt* to remain calm, and assess the situation. If a crash crew is on hand allow them to bring the situation under control before attempting escape. If there is no crash crew the following guidelines should apply:

(1) If no fire is apparent open the canopy by some means which will not ignite possible fuel fumes (manually, by use of canopy break-away tool, etc.).

(2) If fire is noted jettison the canopy and abandon the airplane.

At the recent F-100 Flight Manual Command Review Conference this subject was discussed. The resulting decision, concurred in by DTIG, was that in the emergency procedures the step CANOPY-JETTISON will be changed to CANOPY-AS DESIRED. A condensed discussion, similar to the one presented here, will then give the aircrews guidance on the many factors involved. ☆

FAA ADVISORIES

Robert L. Terneuzen,
FAA Liaison Officer
Directorate of
Aerospace Safety

THANKS — A great big "Thank You" to all the fellas who wrote those encouraging letters. With time, and your help, the column may prove to be of some value. To help in this effort, how about more suggestions and questions? Why not let me hear from you— pilots, AFCS and FAA controllers? I'll bet we can generate enough interest between us to make this page a real source of information. If you have a question that stumps me I promise to research and publish the answer, or if it's a suggestion having to do with traffic control, I'll submit it to the FAA or AFCS for further comment and discussion. You've all grumbled at times about having something done about this or that; now here's your chance to be heard and perhaps helped. Feel free to submit your gripes. Just remember, give me a break and include a suggested improvement in the situation. Address your correspondence to either the editor or: FAA Flying Safety Liaison Office
AFIAS-F8, Norton AFB, California.

RADIO TECHNIQUE — FAA, ARTC Centers have noted that many USAF pilots are not reporting their altitude in INITIAL radio transmissions. The information concerning this procedure is published in both the Enroute Supplement (page 291) and FLIP Planning, Section II (page 10). Example: "Chicago Center, Air Force 12345 Joliet niner thousand, over."

LIGHTNING AND CAT REPORTS — Washington/FAA has requested that all pilots report lightning strikes, clear air turbulence and turbulence that has caused damage to aircraft or injury to passengers or crewmembers.

Prompt reporting of strikes and particularly turbulence can then be relayed to following aircraft for possible route or altitude changes.

EVALUATION TO REDUCE POSITION REPORTS IN A RADAR ENVIRONMENT — The safety and effectiveness of air traffic control depends largely on accurate position information. In order to provide separation and safely expedite aircraft movements, controllers must have accurate information on the progress of each IFR aircraft. Radar is the most accurate, least time consuming media through which this information is obtained. In a radar environment where aircraft position information is updated at frequent intervals pilot position reports are generally superfluous. Elimination of these reports can substantially reduce frequency congestion, provide controllers additional time to analyze the constantly changing traffic situation and permit the flight crew to devote more time to other cockpit duties.

The Air Traffic Service, FAA, has developed a program to eliminate pilot position reports over designated compulsory reporting points while a flight is operating in a radar environment. An evaluation of this program has been underway in most Western and Central Region facilities for some time. Pilot reaction to this program has been highly favorable and no major discrepancies have been detected. However, since this represents a major change in long-established air traffic control procedures, prior to implementation the evaluation of this program will be expanded to include most areas of radar coverage within the U. S.

The following procedures will be used in conducting this evaluation:

- Pilots of radar identified aircraft which will remain under radar surveillance may be authorized to discontinue position reports over fixes designated as compulsory reporting points. The controller will grant this authorization using the phraseology "OMIT POSITION REPORTS."
- When a pilot has been authorized to omit position reports, the controller—at the time radar service is terminated or at his discretion—will issue instuctions to resume normal position reporting using the phraseology "RESUME NORMAL POSITION REPORTING."
- Pilots shall monitor normal air traffic control communications frequencies. On initial contact when changing frequencies, pilots should establish contact as specified giving altitude or flight level.
- Pilots of aircraft operating below flight level 240, who have been advised to omit position reports, will be furnished the appropriate altimeter setting when passing compulsory reporting points as observed by radar. ☆

Services Standardize Safety

New agreements to standardize aviation safety pracices, procedures and definitions have been reached in tri-service conference at the Army Aviation Center, Ft. Rucker, Ala.

In a two day meeting, April 14 and 15, Brigadier eneral Jay T. Robbins, director of Aerospace Safety JSAF, Rear Admiral E. C. Outlaw, commander of the Vavy Aviation Safety Center, and Colonel Robert M. Hamilton, director of the Army Board for Aviation Acident Research (left to right in accompanying photo), lso laid the groundwork for future agreements in other reas of aviation safety.

A major agreement was the establishment of identical riteria and definitions for major and minor aircraft ccidents. Regulations in each of the services are exected to be changed.

Also discussed were the various kinds of exposure for omputing accident rates. All three services will soon ave the capability of computing rates based on flying ours, landings and flights. For purposes of in-service ccident analysis each service will use the exposure or xposures that best suit its particular requirements. or the purpose of consolidated reports or releases the hree services can mutually agree on a suitable rate.

The three services also agreed to use common terms in efining ejections and parachute sequence, with use of ommon terms to be limited to the three aviation safety enters.

The Army, Navy and Air Force leaders decided to continue their efforts toward common medical reporting for accidents and greater cooperation between accident investigators and crash rescue personnel.

First steps were taken toward a program to orient the public on its conduct at scenes of aircraft accidents. A broad public relations program will be developed with the goal of educating the public on not handling aircraft parts found at accident scenes and on not destroying other evidence that would be helpful to investigators.

RED FLIGHT'S RECORD

It's Red Flight Day in Selma, Ala., and allas County, as Bernard A. Reynolds, allas Co. Probate Judge (left), and the onorable Chris B. Heinz, Mayor of Selma right), sign a joint-proclamation announcng the event in the presence of Col Richrd L. Ault, base commander, Craig AFB, la.

When a T-37's high speed tires squeaked sharply on the concrete runway at Craig AFB one morning last winter, more than another routine pilot training flight had been completed. The safe termination of that flight marked the 50,000th consecutive hour of accident-free flying for Red Flight personnel.

In recognition of the Safety achievement, Chris B. Heinz, Mayor of Selma, Alabama, and Bernard A. Reynolds, Dallas County Probate Judge, signed a joint proclamation specifying one day as *Red Flight Day in Selma and Dallas County.*

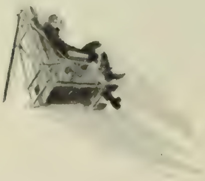
Since then the record has been kept intact. Red Flight pilots and students had flown 52,275 consecutive accident-free hours as of 1 April.

During the 83-month period since 5 April 1957, the flight has graduated more than 650 students while they and their instructors made more than 208,000 takeoffs and landings during more than 34,700 flights.

The flight's 14 instructor pilots have never had an aircraft accident of any kind. Eleven of them have over 1000 hours of rated accident-free flight time in aircraft of all types (recip and jet); 10 have earned Distinguished Jet Pilot Certificates for having completed 1000 rated accident-free hours in jet aircraft. Six of those 10 men have flown more than 2000 safe hours: Capt Rollin R. Lerch, Flight Commander (2137); Capt Donald W. Schalk (2502); Capt Kenneth R. Shatzer (2338); Capt Karl E. Klute (2110); Capt James H. Fleming (2131), and Capt Lawrence E. Butts (2198).

"Marks such as these don't just happen," says Col Richard L. Ault, Craig AFB commander. "They are the byproducts of top aircraft maintenance, standardized training methods and men who won't settle for being less than the best pilots in the business. ☆

Aerobits



LOCATOR BEACON—A pair of Navy aircraft were on a training mission when the wingman had to eject over rough mountainous terrain. The situation was such that he did not have time to inform the lead pilot. In fact, Lead did not know what had happened until he heard an emergency beeper on Guard channel. The beacon was attached to the wingman's seat pack and the lanyard was attached to the seat. When the pilot separated from his seat, the beacon was automatically activated. Lead looked around, noted that his wingman was missing and made a quick one-eighty. He spotted his buddy and alerted the Western Air Rescue Center which sent a helicopter. The pilot was located, recovered and evacuated for medical treatment of an injured back within two hours.

Undoubtedly this pilot's beacon made possible his quick recovery and possibly saved his life. Air Force crews will soon have similar equipment in the URT-21. Testing should have been completed by now and these beacons should be showing up in the P.E. shops soon.

HAZARDOUS CARGO—Recent occurrences indicate that a tightening up is in order in the movement of explosives and other hazardous cargo. For example, a contract carrier pilot parked his aircraft loaded with explosives in front of Base Operations. About 30 minutes later he notified the dispatcher as to the nature of the cargo. Air Freight had been advised as to the flight and cargo sometime previously but had not notified Operations. The pilot, assuming Operations was familiar with the cargo aboard, did not report his cargo prior to landing.

Carelessness of this sort, along with many reported discrepancies in packaging and marking seems to be common. Action on the part of all concerned is called for immediately before some act of carelessness results in a catastrophe. In view of the above, the following minimum controls are emphasized in addition to adherence to the general safety precautions and compatibility chart contained in AFM 71-4:

1. Aircraft carrying high explosives should not be parked among other transient aircraft or near any vital installation or building.

2. Notification must be received prior to the aircraft's landing.

3. Crews and passengers must be completely briefed on nature of items and proper precautions to be observed.

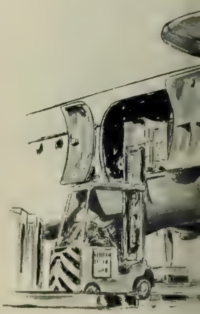
4. Commanders will be briefed regarding the properties, their proper handling, first aid, and measures to be taken in the event of an inflight emergency.

5. Commander will prohibit smoking and ignition of matches or lighters in compartment containing explosives.

6. Fire Department will be notified of any aircraft carrying explosives—parked, landing or taking off from the base.

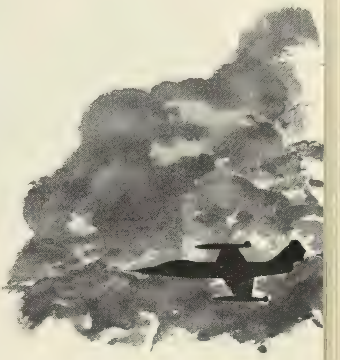
7. Pilot will make known the contents of the cargo and request appropriate priority for his aircraft during takeoff or landing, taxiing and parking aircraft loaded with explosives.

The success of the explosives safety program during air shipments and the prevention of a possible disaster are dependent upon how well we disseminate these instructions and insure understanding by those concerned.



IN CASE OF EMERGENCY. The Air Force has provided quite a few devices and procedures for use in case of emergency. And Air Force pilots spend a lot of time learning how to use these devices and practicing emergency procedures. Here's a series of events that illustrate in the last four minutes of one mission, why it's all necessary.

On descent to penetration altitude the F-104 pilot noticed heavy fumes in the cockpit as he reached 23,000 feet. Within seconds the oil pressure dropped from 30 psi to 12 psi, the oil level light illuminated and nozzle failure was experienced. The pilot declared an emergency and requested a direct vector and mileage to the field. GCA responded immediately with the information requested and, because of the proximity of the field, initiated descent immediately. The aircraft entered the tops of a heavy overcast at 18,000 feet. Configuration was: 89 per cent RPM, takeoff flaps and 275 knots IAS. Extremely heavy rain and turbulence were encountered in the descent and GCA gave constant heading corrections and distances to the approach end of the active runway. Based on this information the pilot varied his rate of descent by use of speed brakes so as to break out of the overcast as close in to the field as possible. Breakout occurred at 3500 feet, about four miles from the end of the runway. Oil pressure had dropped to 6 psi and nozzles were at 7/10 at this time. A straight in approach with takeoff flaps was established with gear held until flare. Final was flown at 200 knots and touchdown was made 1000 to 1500 feet from the threshold. The drag chute was deployed and max braking attempted. The pilot began experiencing directional control problems and the tower advised that the chute was a streamer. The pilot began using only moderate braking to retain directional control as a barrier engagement was inevitable. The MA-1 barrier was engaged at the center of the runway with the cable catching the main gear doors. Throttle was stopcocked at engagement. Runout was 323 feet. No damage to the aircraft.

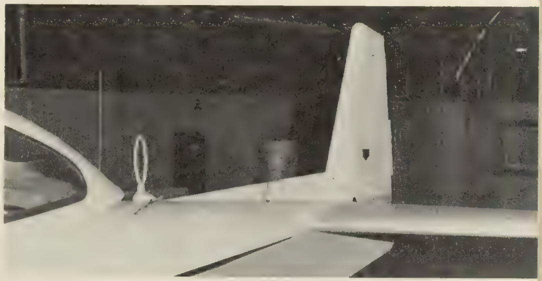


UPS AND DOWNS. On takeoff the pilot noted that the elevator trim was operating in reverse. The pilot recognized the problem immediately and took action to retain complete control of the aircraft. He remained in the local area with a chase aircraft until fuel was burned down to landing weight. A successful landing was accomplished. Maintenance had been performed on this aircraft just prior to this flight for removal and replacement of the elevator trim actuator. During repair of the elevator trim actuator, the actuator was inadvertently wired in reverse. The actuator was installed on the aircraft and a trim check was made; however, the reverse trim was not detected by the person installing the actuator, the inspector who signed off the installation, the crew chief on preflight, nor the pilot during his preflight check.

Courtesy ATC's "Approach to Safety"

AERO CLUB AIRCRAFT—A broken front spar of an L-17 horizontal stabilizer was discovered recently during postflight inspection. The spar was broken across ts entire thickness immediately outboard of the root rib, ncluding gusset shown in FAA A.D. Note 52-26-1. The aft spar and root rib were all that kept the stabilizer attached to the aircraft.

AFLC recommends that all aero clubs possessing L-17s have the aircraft inspected. Inspection can be nade by removal of stabilizer root fillets and, with inspection mirror and light, forward spar can be thoroughly inspected at the rib and forward stabilizer attach fitting.



Aerobits

ACCESS DOOR DIDOES. As the airspeed increased on climbout the pilot noticed a buffeting of the rudder and a slight vibration in his trusty T-Bird. All engine instruments were normal so the gear was recycled on the assumption a gear door might be hanging. This did not correct the situation so another aircraft was requested to make a visual check. The chase pilot advised that the left upper engine access door, plenum chamber door, was full open. A controllability check monitored by the chase pilot revealed the door stayed full open at 160K, approximately four inches open at 130K and full closed at 120K. A straight in approach was made at 120K. Landing was without incident.

Investigation revealed all fasteners were intact except one which was broken, obviously the only one used to secure the door. The aircraft was airborne for approximately 25 minutes, at speeds up to 250K, before the fastener failed. Had it failed at the higher speeds, the door could have been torn from the aircraft, damaged the tail section and resulted in complete loss of control. It has happened in the past.

The aircraft had been ground aborted the previous day for fluctuating fuel pressure. An engine specialist had opened the panel to bleed the fuel pressure transmitter and failed to secure the door when the job was completed. He also neglected to make a 781 entry referencing the loose panel. Postflight was not required since the aircraft was not flown. On the early morning preflight, the crew chief failed to see the loose fasteners. The IP and student then failed to catch the discrepancy on their preflight. At least three persons should have looked at the fasteners but not one noticed they were loose. Why?

Cold? Darkness, no flashlight? Rushed preflight?

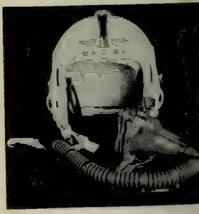
Courtesy ATC's "Approach to Safety"

P.D. MCCRIPE—Those letters stand for something and if you don't know what it is, you'd better take a walk over to the P.E. shop and find out. The crew of a T-Bird almost bought it the other day when the pilot tried to operate at high altitude while breathing ambient air.

This crew, a pilot and observer, was scheduled to fly a mission at 39,000 feet. At about 35,000 the pilot's symptoms of blurring vision and blue fingernails made him suspicious and he went to 100 per cent oxygen. Soon he began to fly erratically, diving and climbing the aircraft and allowing the wings to drop first on one side and then the other. Finally, after the back seat occupant urged him several times to descend, he went into a dive with full power. He cut the power only at the urging of the observer. At a lower altitude, the pilot's symptoms disappeared and he landed the aircraft.

Inspection of the aircraft oxygen system revealed no discrepancy. Condition of the masks of both men was a different story. Both were dirty and had a distinct odor due to improper cleaning. Besides, they had not received routine care in 60 to 90 days. The real culprit was the CRU-8/P connector on the parachute harness which failed at the snap ring, allowing the pilot to breathe ambient air.

The P.E. shop personnel deserve to get their knuckles rapped, but how about the pilot? Proper preflight inspection of the equipment should have turned up the faulty connector as well as the overall condition of the mask. Remember P.D. MCCRIPE. ☆



WELL DONE

CAPT. CHARLES W. BROZ

59 FIGHTER INTERCEPTOR SQUADRON, GOOSE AIR BASE, LABRADOR

On 4 September 1963 at Goose Air Base, Labrador, Captain Charles W. Broz and another squadron pilot, Captain Arthur P. Kearney, were flying a training mission in a TF-102. After completing the first intercept at 30,000 feet, 150 miles northeast of Goose Bay the pilots were attempting to retract the armament doors when an explosion was heard. Air rushed in around the cockpit and the aircraft began to vibrate considerably. The right front windshield had blown out, subjecting both pilots to severe windblast and extreme cold. Captain Kearney, in the right seat, grabbed a piece of the radar hood, which was breaking up, to hold in front of him and lowered his visor. Captain Broz declared an emergency and began a descent toward the base. Armament doors could not be retracted. This plus the lower altitude necessary to avoid the extreme cold more than doubled the fuel required for return to base. During descent least vibration occurred between 220-240 KIAS. Aircraft was leveled between cloud layers at 15,000 feet and slowed to see if landing should be attempted.

At 200 KIAS the buffeting and vibration became severe. In spite of this Captain Broz decided to attempt the landing. He began an IFR descent planning to make a TACAN approach to the base, but the TACAN proved unreliable. At 8000 feet bits of glass began to fly into the cockpit and the glass covering the instruments began to ice over. Captain Broz scraped the ice off with his hand, while Captain Kearney held up the pieces of radar hood obstructing the instruments. As the aircraft descended, buffeting became such that reliable communications between aircrew and air to ground could not be maintained. This ruled out a radar approach. By this time both pilots were extremely cold and shivering uncontrollably. Captain Kearney, subjected to the full windblast, was becoming incapacitated. They climbed to get VFR on top and were informed that an F-102 would be vectored to them. They broke out of the clouds at 21,000 feet and joined on the other aircraft. Penetration was begun at 240 KIAS. The clouds were thick enough to make formation flying difficult even under normal circumstances. On final approach buffeting became so severe that Captain Kearney could not read the large numbers on the lead aircraft. The weather proved to be lower than reported so Captain Broz flew wing to 500 feet and then made a normal landing. Captain Kearney believes that ejection would have been impossible for him after the second descent. He and Captain Broz had been exposed to severe cold and windblast for 45 minutes. Both pilots were taken to the hospital, warmed up, checked for frostbite and released.

Captain Broz distinguished himself by meritorious achievement while participating in aerial flight. This achievement has earned him a WELL DONE. ☆

CITATION for the award of the 1963

Daedalian Flying Safety Trophy

MATS

The Daedalian Flying Safety Trophy is awarded to the Military Air Transport Service for having the most effective aircraft accident prevention program of all major air commands for the calendar year 1963. During the period of this award, the Military Air Transport Service established the lowest accident rate in its history. The magnitude of accident reduction attained was outstanding in view of increasing operations directed toward military mobility exercises and special assignment missions. Again in 1963, of all the passengers carried on scheduled transport missions, not one life was lost. By conserving materiel and manpower while accomplishing its worldwide commitments, the Military Air Transport Service has made a substantial contribution to the mission of the United States Air Force. This accomplishment was the result of superior teamwork of unit commanders, aircrews, maintenance and support personnel. The achievement made by the Military Air Transport Service in aircraft accident prevention perpetuates the highest standards and traditions established for the Daedalian Flying Safety Trophy, and reflects the highest credit upon the command and the United States Air Force. ☆

☆ U. S. GOVERNMENT PRINTING OFFICE: 1964 — 217/10

29.1305
FLYS

AEROSPACE
SAFETY
UNITED STATES AIR FORCE

ONE CANDLE FOR A PIECE OF CAKE
SEE PAGE TEN

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JULY 1964

AEROSPACE SAFETY

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VOLUME TWENTY NUMBER SEVEN — USAF RECURRING PUBLICATION 62-1

FALLOUT

QSY TO XXX.X MC IMMEDIATELY

The needle jiggles, DME runs out, you are RAPCON cleared Nr 1 for penetration. It's a dark and stormy night except for the occasional flashes of lightning. So—out with the garbage, back on the throttle and into the CB's. Rate of descent is like a free floating manhole cover; the brain bucket bounces around under the canopy; the panel dances in front of your eyes; and all of a sudden the gages say it's time to turn and roll out on final.

The controller hands you off to GCA final XXX.X MC *IMMEDIATELY*. Now let's see, what channel is XXX.X MC? Where did I put my flashlight and magnifying glass? Oops! (Gad! this little mother is touchy in roll.) Oh, here it is—button #17.

MORAL: Revise your frequency cards and modify the hot frequencies to bold print so the jet types can get the information real quick like. You may save another "cause unknown" type investigation.

Maj Carter H. Phillips
Training & Stand. Branch
Hq 2851 ABWg (AFLC), Kelly AFB, Tex

P.S. The Recip types might want i
too!

*Here's a sample Major Phillip
sent along.*

STANDARD UHF CHANNELS

236.6	USAF Twr/2nd	**2**	**320.1**	Kelly Tower	**1**
243.0	Mil. Emerg.	**G**	**340.2**	Navy Tower	**7**
255.4	Flt Svc VFR	**11**	**344.6**	Forecaster	**13**
257.8	Civil Tower	**4**	**353.5**	SAT Apr Cont	**15**
269.1	SAT Apr Cont	**16**	**354.4**	SKF Flt Test	**12**
272.7	Flt Svc IFR	**5**	**364.2**	G.C.I.	**10**
275.8	Gnd Control	**3**	**372.2**	Base Ops	**6**
305.4	UHF/DF	**14**	**381.4**	SAT Dep Cont	**8**
317.5	SAT Dep Cont	**9**			

KELLY GCA FREQUENCIES

327.5	**17**	**389.9**	**19**
338.6	**18**	**396.1**	**20**

AFPS SA MAR 64, 60

STANDARD ALTIMETER

I've read with great interest you
article "Airspeed Out" in the Ma
issue on the loss of the pitot-stati
system in a jet aircraft. The te
group did a fine job in giving u
some tips on flying safely with on
or more air pressure instruments ir
operative, but haven't they ove
looked one very important instru
ment? The cabin altimeter is stanc
ard on the T-33 and most jet aircraf
It is independent of the pito
static system and accurate to abo
1000 feet with the heat off and th
speed brakes up. In case of altimet
failure, a pilot could dump h
cabin pressure and read his altitud
so that another aircraft could re
dezvous with him. He could prol
ably let down slowly too if he r
membered that the cabin altimet
has a lag and is giving pressu
altitude only.

Please continue with your e
tremely useful articles.

Lt Robert Boring (student pilo
3550 Student Squadron
Moody AFB, Georgia

A COMMANDER'S REMINDER

aissance Squadron (MATS)
NITED STATES AIR FORCE
Hunter Air Force Base, Georgia

REPLY TO
ATTN OF: 53WRSC

13 Nov 1963

SUBJECT: Flight Safety

TO: All Aircrew Personnel

1. This period of transitioning into a new mission for most of us, and into a new aircraft for some of us creates, in itself, a situation conducive to mistakes. Mistakes, of course, lead to accidents. I urgently ask that all aircrew members take full cognizance of our susceptible situation and make it a matter of individual challenge to avoid all possible risk of accidents.

2. Avoidance of accidents must be the personal goal of each of us. To be effective at this we must make accident avoidance a part of our way of life; we must consider it a science, and learn that science to the letter.

3. The most important principle of the science of accident avoidance is to avoid exposure to accidents. Obviously, if we stop flying we will avoid flying accidents, but we can't do this because flying is our business. There are some things, however, which we can and must do to lower our exposure to flying accidents and thereby avoid them. First, we must avoid marginal situations. For example, each flight should be planned with a little extra, as a margin for error. Look very carefully at your reserve fuel; always have an alternate airport. Don't under any circumstances participate in unauthorized maneuvers. Don't fly formation, except in cases of dire emergency. Don't hesitate to make intermediate precautionary stops when any valid reason presents itself. If you're an instructor, don't hesitate to take over, even for a moment. Don't, under any circumstances, think you can make the aircraft do anything it's not designed to do.

4. There are some who have the feeling that a positive, aggressive attitude toward safety means a negative attitude toward the mission. This is not so. Our mission requires continuous and dependable daily reconnaissance flights. Unless we make safety our first and most important mission, we cannot expect to be dependable or "continuous" regarding the rest of our mission. There are some who are embarrassed by taking positive precautions to avoid accidents such as by a "go around" or by proceeding to an alternate landing field. This is childish. It's far better to feel embarrassed (even though you needn't) than it is to "buy the farm."

5. Gentlemen, we have a great number of fine assets: good aircraft, highly qualified crews, and an interesting, high priority mission. Let's take the challenge and, through good sense, intelligent caution, and unswerving crew discipline, show the world that it's possible to run a highly mission conscious outfit with complete avoidance of accidents, now and in the future. Thank you.

ARNOLD E. ZIMMERMAN
Lt Colonel, USAF
Commander

Tips on T-Storms

Thunderstorm activity will reach its annual maximum in the few months ahead. Pilots and navigators who have to deal with thunderstorm phenomena can benefit from a quick refresher. Following is a summary of thunderstorm features, beginning with some definitions, prepared primarily by United Airlines.

SIGMET. A Weather Bureau advisory concerning significant weather developments of such severity as to be potentially hazardous to transport category and military aircraft. SIGMETS are for periods of two to four hours and cover (1) tornadoes, (2) severe turbulence, (3) squall lines, (4) dust-sand storms, (5) hail three-fourths inch or more, (6) heavy icing.

AVIATION SVR WX FCSTS (WW). Warnings for civil aviation are issued by the Weather Bureau Severe Local Storms Center (SELS) at Kansas City, and are basic forecasts that are issued farther in advance and for longer periods than the SIGMETS. They are used by FAWS centers for guidance in issuing short-period advisories. Military Weather Warning System (CONUS only)—this system provides four scheduled weather warning advisory charts issued by the Kansas City Centralized Forecast Center. These forecasts are transmitted via COMET II weather teletype circuit every six hours and are valid for the ensuing 12-hour period. In addition Kansas City Centralized Forecast Center provides spot weather warnings to over 500 military locations when required. Warnings are issued for the following criteria: (1) tornadoes, (2) thunderstorms (regardless of intensity), (3) hail, (one fourth inch or larger), (4) surface winds (exceeding 35 knots), (5) rainfall (more than two inches in 12 hours), (6) freezing precipitation, (7) snowfall (more than two inches), and (8) severe dust storms. These forecasts and warnings are tailored to meet the requirements of the USAF, US Army, ANG and Air Force Reserve units.

SEVERE THUNDERSTORM. For the purpose of the WW, the Weather Bureau defines a severe storm as one that has (a) surface wind gusts of 65 knots or more or (b) sustained winds of 44 knots or more or (c) three-quarter inch hail or (d) severe turbulence.

THUNDERSTORM GEOGRAPHY. Where are tornadoes found most frequently? In "Tornado Alley" which runs from Oklahoma NNE to Iowa. In this band, which has no known counterpart anywhere in the world, there is a pronounced maximum centering on Wichita where six tornadoes occur every average year within an approximate radius of 55 miles. There is a second "Little Tornado Alley" in the south running from Jackson, Mississippi, to Columbus, Georgia. Charleston, West Virginia, enjoys the least exposure of any United terminal east of Grand Junction.

Where do nocturnal thunderstorms occur most often?

The maximum is closely parallel to Tornado Alley running from Oklahoma to Iowa but the belt is broad. Chicago lies well within the eastern edge and North Platte the western fringe. A second area of high frequency is found along the gulf coast at New Orleans, Mobile and Tampa.

Are there favored areas for squall lines to form?

We can forget the true squall line as an operating problem west of Denver. They have occurred but only at the rarest intervals. From Denver east severe squall lines may occur anywhere each year. If there is any favored section for formation, it would be to the southeast of Lakes Michigan, Erie and Ontario in March, April and May when the lakes are still cold in comparison with the Tropical Gulf airmasses moving in against them.

Where is the "Marfa Front" found?

The Marfa Front lies, day after day in summer, in a north-south line running typically along the eastern borders of Colorado and New Mexico and thence south to Marfa, Texas, where the name originated. It is a dewpoint "front" separating moist Gulf air with dewpoints in the 60s on the east side from continental air and dewpoints in the 20s and 30s on the west side. It has great significance in connection with development of squall lines and tornadoes. It may be entirely cloudless.

Where do we find our most troublesome orographic storms?

Orographic thunderstorms are more frequent in the four-state area of the southern Rockies in July and August but these storms don't compare in potency with those found in the southern Appalachians from northern Georgia to Pennsylvania. Storms in Arizona and Colorado often have surface dewpoints in the 30s but those in the southeast are invariably in the 60s.

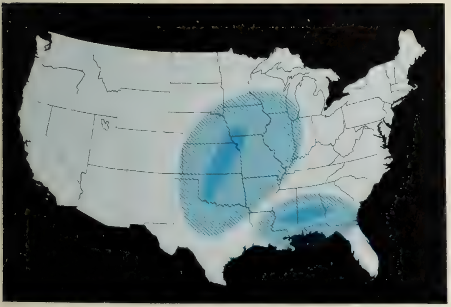
Are there favored areas for big hail to form?

Yes! The worst hail belt in the country is a band running north-south from about Miles City, Montana, to Rapid City, South Dakota, to Sidney, Nebraska, to Goodland, Kansas, to Amarillo, Texas, to Marfa, Texas. (Note how this parallels the Marfa Front). There are counties near Goodland where ranchers must pay prohibitive premiums of more than $20 per hundred to insure their crops against hail damage. Big hail can also occur all through the east and midwest but with nothing like the frequency found in the high plains. Air Force jets have encountered four-inch hailstones at 30,000 feet and three-inch hailstones at 40,000 feet through the Marfa Front zone at Amarillo and Goodland. Three-inch hailstones occur somewhere in this belt on the ground every year.

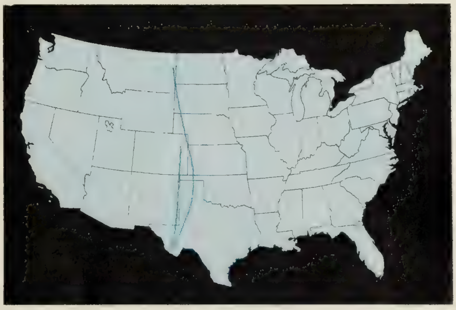
Are there favored areas for static discharges to occur? Yes. The recent UAL survey showed maximum piston cases from Lake Erie eastward to New Jersey while the maximum jet incidents were found in the Chicago traffic pattern.

Rather surprisingly, one of the most susceptible airway segments (on the UAL system) seems to be the Portland-Seattle. This is the best proof we have that active thunderstorms are not necessary to produce the discharge. They will occur wherever we have a high exposure to IFR flight through clouds with temperature near 32°F and icy-type precipitation occurring.

THUNDERSTORM PHYSICS. Why would



Tornado Alley (Okla. NNE to Iowa), Little Tornado Alley in Southeast US, and nocturnal thunderstorm area (hatched area) are shown above.



The Marfa (dewpoint) Front lies day after day in summer from Marfa, Texas, northward along eastern borders of New Mexico and Colorado.

Tips on T-Storms

Storm A be rough and Storm B smooth when they look alike from outside?

Storm A is in the building state, Storm B in the decaying stage. Even radar may miss this distinction at the first stage of development. To the experienced observer, the hard cauliflower outlines of the cumulonimbus are the tipoff the storm is new and building.

Can damaging hail occur at 40,000 feet?

Yes! A number of Air Force jet aircraft have been badly beaten up at that level in Texas and Kansas. Typical "last words" read like this, ". . . we were flying IFR in cirrus type clouds" or ". . . we had just entered altostratus type clouds."

What causes nocturnal thunderstorms?

A low level jet at 3000 to 8000 feet and strong warm air advection at those levels are generally considered to be the prime ingredients. The jet is from S or SSW and often exceeds 50 knots at 3000 msl. Over the ocean, where storms also show a maximum at night, the explanation has to be different. In areas like the Gulf of Mexico it seems likely that slight cooling at upper levels is what upsets the delicate stability balance prevailing in the tropical air.

Why does Omaha, for example, have more thunderstorms at night than during the day?

Because it lies right in the path of the low-level jet stream from the S or SSW at 3000 to 8000 feet that invariably reaches a maximum speed during the period from midnight to 0500 CST. This jet characteristically brings in warmer air from Texas to steepen the lapse rate and cause overturning.

Tall thunderheads that have lightning flashing incessantly are most likely to spawn tornadoes.

Do nocturnal thunderstorms always have high bases?

Don't count on it. Some nocturnals generate full-fledged squall lines attended by hail, severe surface gusts and thick scud clouds or roll clouds.

Does lightning have anything to do with tornadoes?

It has been observed that tall thunderheads that have lightning flashing incessantly are most likely to spawn tornadoes. Some scientists believe electricity has an important role in generating large tornadoes.

How high do tornado funnels extend? There is increasing evidence that they reach up to 30,000 feet or higher at times.

There was one instance several years back in Arkansas where an airline captain reported a funnel reaching down from a cumulonimbus overhang starting at 30,000 feet estimated. More recently a U-2 aircraft at 65,000 feet photographed a tornado-spawning cumulonimbus with a hole in the top at 51,000 feet which was 6.3 miles in diameter and rotating. Speed of rotation was estimated at 90 knots near the top and considerably higher down inside.

What is the role of electricity in the thunderstorm mechanism?

We don't know. In the past it was always assumed that shattering raindrops generate lightning discharges. The Arthur D. Little researcher, Dr. Bernard Vonnegut, has turned up impressive evidence that electrical charges in the atmosphere may precede the development of large cloud drops and rain.

What conditions precede a static discharge?

This we do know, thanks originally to a study by TWA's E. J. Minser back in the '30s. The factors that Minser discovered to be associated with the static discharge on the DC-2 and DC-3 are just as appropriate today with the subsonic jets. These are typically:

1. Flight on instruments or in and out of clouds.
2. Air temperature 40° and lower (true). (A recent UAL survey of 100 jet discharges showed 67 per cent between 30°F and 45°F.)
3. Active precipitation with some icy types involved.
4. St. Elmo's Fire. (Not always visible.)
5. Radio static. (This not as severe today.)

Do the jets have a lesser exposure to static discharges?

Given the same meteorological conditions, the jet should be more prone to discharges. Since the jets are not exposed to the same conditions at cruising levels (because of low temperatures and minimal water content), they are experiencing fewer "strikes" than the pistons and turboprops. (In the recent UAL survey, 78 per cent of the jet discharges occurred during climb or descent.)

Can anything be done to avoid static discharges?

The only sure evasive action is to avoid IFR flight through clouds and mixed precipitation types. Radar can help on this—winter as well as summer—but traffic rules and procedures obviously conspire to make this impractical in most instances. It is unnecessary for radar to show "cells"—grainy or fuzzy echoes may produce discharges. As increasing signs point to an impending discharge, the only defense is to turn up the cockpit lights brightly and to have one pilot concentrate on looking away from the windshield for protection against the blinding flash. The discharge flash may be the only "lightning" observed. ☆

When the whole works goes sour the pilot will yelp for help! But the wise man knows that when trouble begins is the time to . . .

GET THE WORD OUT!

Headquarters Air Rescue Service, Orlando AFB, Fla.

Maybe you've never had a serious aircraft emergency — good. Maybe you never will have one —even better. But for the thousands ho have had 'em and for the other ntold and unnumbered thousands ho will one day face their own per-onal moment of truth in the sky, here is some consolation in know-ng you are not alone. A lot of hought, planning, expense and ex-erience has gone into helping you —and others like you—out of des-erate jams. The machinery stands eady. The big question is: Do you now how to help youself?

The National Search and Rescue lan, AFM 64-2, integrates all nited States agencies, military and ivil, having search and rescue fa-ilities, into a powerful force for the rotection of life and property—amely, yours. It also provides for he effective use, on a voluntary asis, of a wide array of specialized earch and recovery groups, state, unicipal and private, who are con-tantly ready to contribute their kills and facilities to the humani-arian effort.

Within the Continental United tates, the organization which di-ects the employment of this wide-pread network of search and rescue acilities is the Air Rescue Serv-ce. And through a world-wide network of Air Rescue centers, squadrons and detachments, the ARS is constantly on the alert to provide professional aid and assistance on a global basis. On any given day, Air Rescue personnel may be participating in the recovery of an astronaut returning from outer space, an emergency medical evacuation in Panama, a search for missing boy scouts in Indiana, in the escort of a crippled airliner over the Atlantic Ocean—or saving *your* life.

In order to perform its humanitarian mission, however, the Air Rescue Service must be aware of the need for assistance. The private pilot who departs on a cross-country flight without filing a flight plan, the military pilot who neglects to report a malfunctioning engine in flight, or any pilot who is reluctant to admit that he is lost, is contributing to a situation where extensive delay may occur before knowledge of the need for emergency assistance is made known to Rescue forces. All the rescue facilities in existence will be valueless to a victim until his need is known. In brief, if you don't get the word out, chances are you're a gone gosling.

The importance of the time factor cannot be over-emphasized. Minutes mean lives! The probability of finding survivors and their chances of survival diminish with each minute that passes after an incident occurs. Records have proven that the life expectancy of injured survivors decreases as much as 80 per cent the first 24 hours following an accident, while the chances of survival for even uninjured survivors rapidly diminish after the first three days. Naturally, individual incidents will vary with local conditions such as terrain and climatic factors, ability and endurance of the survivors, emergency equipment available to the survivors and other critical variables.

The filing of an accurate flight plan before departure is of utmost importance. While this is a matter of routine for military pilots, many Air Force personnel are engaged in aero club or private flight activity, and should be thoroughly indoctrinated in the necessity for this procedure. As a minimum, before takeoff every pilot should leave information of his destination and proposed route of flight with a reliable person. Almost equally important is the necessity of closing the flight plan upon arrival at destination or alternate. Failure to do so may result in wasted and costly search effort and even the risk of death or injury to search personnel.

A recent ARS mission is a case in

GET THE WORD OUT! *continued*

ARS HH-43 helicopters provide fast, airborne rescue service. They lower fire suppression kits and use rotor wash to blow flames away from cockpit areas.

point. Happily, as things developed, it involved no loss of life. As a matter of fact it did not even involve an aircraft accident although the pilot's lack of professionalism and lack of consideration for others might very easily have caused one during the search phase of the mission.

The pilot of a four-place, single engine, light aircraft took off from Cincinnati. He filed no flight plan but well founded rumor had it that his destination was a large city in the blue grass regions of Kentucky not too far from Churchill Downs.

Enroute to his destination, the pilot of the missing aircraft reported to an accompanying aircraft that he was unable to keep pace with him. Moreover, it was known that the pilot of the missing aircraft did not have charts of the area but did have two-way VHF. The pilot of the accompanying aircraft had charts but his transmitter was not working. The pilot of the accompanying aircraft made two 360-degree turns but was unable to locate his "buddy." He then proceeded direct to his destination and landed. After waiting "a considerable time" the pilot notified FSS of the missing aircraft.

The incident occurred during a period of high flood waters and all airfields on both sides of the cresting Ohio River were checked with negative results. Civil Air Patrol of Kentucky, Indiana and Ohio flew 48 sorties and logged 76 hours and 15 minutes in miserable weather looking for the missing aircraft. The weather was reported as follows: "ceilings 1500 to 3500 with scattered thunderstorms; heavy rains with gusty winds and turbulence in the most probable search area."

Including numerous state police and other agencies, hundreds of people were involved in the search. The pilot was located the following day because he called his place of business. Incredibly, he was calling from Las Vegas, New Mexico.

You, the pilot of an aircraft encountering an emergency, should perform the following actions:

1. If the aircraft is equipped with IFF, place the selector to "Emergency."

2. Immediately contact the communications agency controlling your flight, and advise them the nature of the emergency and your immediate intentions.

3. Transmit MAYDAY or PAN, depending on the degree of urgency, over the emergency frequency followed by the information listed in the back of the FLIP Enroute Supplement. If you are unable to contact the controlling agency, the information should be passed to any agency capable of receiving it.

In accordance with the National Search and Rescue Plan, the emergency report will be passed to the appropriate Air Rescue Center, which in turn will alert and dispatch such assistance as the circumstances dictate.

There are three primary means by which a pilot can make his emergency known: through the transmission of an emergency message; by placing his IFF switch to Emergency, and by flying a triangular pattern. The left triangular pattern will indicate a loss of both radio transmitters and receivers; a triangular pattern to the right will indicate to the radar controllers that messages can be received but not transmitted.

What is an emergency? The dictionary defines it as "a sudden, generally unexpected occurrence or set of circumstances demanding immediate action." The trouble is, the term emergency means different things to different persons. The loss of an engine is infinitely more distressing to the pilot of an F-102 than to another pilot cruising along in a C-130.

Regardless of the type aircraft being flown however, one conclusion is quite clear—when mechanical difficulties develop that could lead to real trouble later on, or if you are uncertain of your position, or if weather is getting the better of you—Get the word out! If time is available contact a ground station; if that is not possible, notify anyone in radio contact and give them the essential facts. Do this even though you feel that no emergency yet exists. Further developments may follow so rapidly and be so critical that further transmissions may be impossible.

Bear in mind that it is far better to over-estimate your difficulty and get an alert message out early than to let false pride cause you to delay calling until it is too late. Once Air Rescue is in possession of this vital information, 90 per cent of the job is done because locating the scene of an emergency incident or crash is the time-consuming task. Recovery is relatively simple.

With the operational use of high-speed jet aircraft, the problem of intercept and escort of these new types of relatively slow Rescue aircraft has become more difficult. However, this problem has been partially overcome by a technique known as the "Maximum Rescue Coverage (MRC) Intercept." Upon receiving a call for intercept, the rescue aircraft proceeds to a point considerably ahead of the high speed aircraft in distress and on its inbound track. On reaching this predetermined point, the Rescue aircraft turns and takes up the same course as the distressed aircraft which is some distance astern. Both aircraft proceed in the same direction until the Rescue plane is overtaken by the distress aircraft which then draws ahead of the Rescue plane. While the Rescue aircraft is only briefly in the immediate vicinity of the other aircraft, the turning point is so calculated that it is at all times in a position to give maximum protection over a maximum period of time to the crew of the distressed aircraft.

If the distressed aircraft is ditched, crash lands, or the crew bails out, the Rescue aircraft will reach the scene within a relatively short time. By tying down the transmitter key, the radio operator can make it possible for the Rescue aircraft to home on, and pinpoint the exact site even after bailout or ejection.

On the other hand, if the commander of the aircraft in distress is reluctant to transmit a call for assistance, he is very likely to be cutting his own throat. Should he eject, bail out, ditch, crash land, or just plain auger in, he is not reported overdue by communications until one hour after his next scheduled reporting time. A thorough communications check is then initiated and, should this prove negative, a search plane is dispatched. During such a period of time, today's high speed aircraft can cover a sizeable chunk of real estate.

Should the pilot be on course when things get out of hand, he is n luck—and congratulations are in order to whomever is navigating. But to find him still requires a large scale route search. If he is off course, he chances for locating him diminsh drastically. The search becomes a major effort, and can consume days, even weeks. Bad weather and errain can complicate things even further.

Every year ARS futilely searches housands upon thousands of square miles of assorted terrain for aircraft hat might have been saved if only word had reached ARS soon enough. Typically tragic is a mission which concerned an aircraft enroute o a Maritime Air Base from Kelavik. Over destination he changed is flight plan for another base, reporting five hours fuel aboard. At 1638 he gave his position and stated he was returning to the original desination at 7000 feet, maintaining ltitude with two engines feathered. No intercept was called for. Last contact was at 1646 when the distressed aircraft requested destination weather and gave an ETA of 1700. At 1737 ARS assistance was requested and a Rescue aircraft was airborne 18 minutes later to attempt an intercept.

The HC-54D Rescuemaster, for years a workhorse in the ARS stable, is slated to be replaced by newer and faster aircraft. For years, intercepts by this aircraft have been welcomed by airmen in distress.

The weather was not the greatest. At the time of the alert the ceiling was 1800 feet and lowering; a solid overcast existed up to 15,000 with an unhealthy icing layer on top and it was getting no better fast. After over two futile hours of effort trying to make contact, the Rescue aircraft returned and the next day a large scale search of the area began. After 11 days, hundreds of sorties, and countless false leads, the mission was suspended.

Four months later when the snow melted, the wreckage of the aircraft was spotted 120 miles off course. Fifty-seven minutes elapsed from the time trouble was known to exist before ARS was called into the act. An earlier call might have enabled the Rescue aircraft to make contact and offer a few constructive navigation suggestions. The men on board might very well be alive today.

If there is no doubt that an emergency exists, use the phrase, "I declare an emergency" when you make your transmission. Don't wait; time is vitally important. Set in motion, as soon as possible, the vast and complex mercy machine that can save your life. The fact that it is better to err on the early side than to be fatally late cannot be over-emphasized. We seldom get much argument on this score but when the chips are down we often find that a false sense of pride will cause a man to delay calling until he's in real trouble. It's the same philosophy that causes a guy to ask for a "practice" DF steer instead of being honest and screaming for the frantic kind. Possibly it's just that we all rather hate to admit that there are times when we aren't in complete command of the situation. Much as we'd like to crystal ball these matters, the fact remains that unless Rescue knows of the problem, we can't help you. Get the word out. ☆

With typical lack of preparedness and know-how, our hero treats his family to an . . .

OZARK OUTING

"There's a rockin' chair in Arkansas, and there I'm gonna go!" So spoke Chauncey Z. Chumley, sometime aviator, Captain, USAF, and summer leave taker with the strongest of get-away-from-it-all motives. The rocking chair bit had to do with nebulous retirement plans, much too distant to concern this carefree individual. All it did indicate was a typical degree of unpreparedness on the part of this safety officer's nemesis. He had two weeks to fritter away. He planned to head a bit south of east, and Arkansas was about as good a tentative goal as any. He'd heard the food was good, living was reasonable, fishing was above average, and casual dress was the going garb.

And, by golly, he'd decided with typical lack of investigation that he'd make this a real family outing; togetherness would reach a new high and the Chumley tribe would commune with nature. No radios, no telephones, no newspapers . . . above all, no TV.

He had seen the brochures (it never rains on a brochure) and had succumbed to the pictured tranquility of the state parks. He had bought a tent, axe, plastic bucket, one-wick gasoline lantern, icechest and various folding accouterments including a stove, stools, table and a frail circular canvas, aluminum and plastic convenience for the youngsters' night-time needs.

They didn't get off to a real good start. One of the kids (his mother always said this one took after his father) got his little finger stuck in the bathroom sink drain when he poked after the toothpaste tube cap. Chum had been roping the tent and other assorted gear on the top of his wife's station wagon when he had to drop everything to try his hand at plumbing. He finally wrenched the pipes loose below the sink—making a mess on the floor in the process—and worried the small digit free. This operation was accompanied by considerable caustic comment which only made the kid bawl louder. Finally, late and ill-natured, the vacationers were aboard and Chaunce rammed out of the driveway in reverse at a speed that might regain a fraction of a second. Going wasn't so bad, but stopping was a bit unhandy. Reverse acceleration had rolled a tiny toy Jaguar out from under the seat and in the way of the brake pedal. Oh well, the skin on the neighbor's tree would grow back, and the right rear fender already had a dent in it anyway.

Near the edge of town Chumley pulled over, then over some more, and finally to the very edge of the pavement in response to a persistent honking by the driver behind. "Why doesn't the idiot pass?" he asked his wife.

The "idiot" didn't pass. He held position alongside, motioning until Chumley rolled his window down, then yelled, "You're losing things off the top."

Chum stopped, got out and took stock of things on top. Sure enough, he hadn't finished his tie-down job. Rope and canvas were streaming and there was only one towel left in the stack he had put up there. He guessed nothing else had been lost. This was more or less verified when retracing of their route for the past few blocks turned up three towels and a wash cloth.

One flat tire, one broken spring, one wheel bearing and one grease job later they rolled past a "Welcome to Arkansas" sign. Mrs. Chum had merely nodded when the fellow who replaced the wheel bearing and greased the chassis commented, "Oughta always have a car gone over and prepared for a trip—saves a lot of grief on the road." To herself she thought, "If I'd said that he'd of hit me."

They found a state park, much like the one in the brochures but with extras like mosquitos and a nest of wasps that one of the small Chumleys discovered with a bare foot. One thing, he had good lungs. The entire camp was soon aware of this. Fortunately, a bearded, tobacco-chewing local slapped some cool mud on the swelling and this cut the decibel level from a piercing scream to an acceptable whimper. "Never saw a kid that didn't like mud, Ma'm," the man said.

Chaunce was in high spirits. He couldn't understand why so many had pitched tents on that rocky old hillside and overlooked the perfectly beautiful, shaded spot here in the glen. In fact, the soft mossy ground underneath the canvas floor gave a carpet effect. He became enthusiastic with the discovery of unknown tent erecting skills and drew the ropes taut. He even bragged to his wife, "I like a neat camp—shows a little pride. Did you notice how many of the other tent guy ropes are loose and sloppy?"

"Oh, boy, now I'm a horse," Mrs. Chum said to herself as she gamely lugged the rear end of the heavy picnic table to the special spot her husband had selected.

Something was wrong with their new stove. It worked fine if you wanted an eight inch flame, but when turned lower it made a noise like "poof" and went out. But the kids were hungry and Mrs. C. well realized that her ever-lovin's ability frequently fell far short of his confidence. She wasn't about to ask him to fix the stove. Somehow, by alternately moving the skillet on and off the fire, she fried up a pan of hamburgers. She grimaced when a drifting leaf fell into the beans, but gamely lifted it out and served.

After dinner her great outdoorsman decided he would try out his new hatchet and split some wood for the fire. She suggested they use it as already cut, but, as usual, he wouldn't listen. It could have been worse. Her worst fears (that he would chop off a thumb) didn't materialize, but she did have to probe with the tweezers to remove a long, ugly splinter.

That night Chumley learned why so many tents had been pitched on the hillside. He didn't know why his wife woke him just because it was raining. "Good for sleeping," he mumbled, rolling over on his cot.

"Get up," she commanded.

"Eee . oo . . ww!" he cried, holding his feet up after he'd stuck them over the side of the cot. The water was a good four inches deep—and cold. "Now I remember," he moaned, "I should have dug a trench around the tent. I knew there was something I'd forgotten."

"Wouldn't have done any good," his wife replied, "every bit of water in the whole park undoubtedly drains into this hole you selected. And see how that side's collapsed—you like a taut tent, you said."

Chumley suggested they stick it out—maybe the water would subside. But when the water level reached the low point on the cots, osmosis had set in and posteriors began to get cold and damp, his wife insisted that they move to the station wagon. They hiked pajama bottoms to half-mast position and waded out, Chum carrying the kids. He didn't say much.

Next day they moved to higher ground and by the afternoon of the second day they had dried out the tent and bedding. Mrs. C. and their eldest had caught colds and made everyone else miserable with their constant sniffling and sneezing, but other than that things weren't too bad. Chum's spirits were still dampened and he had long since given up reminding his brood of the good time they were having.

But they were game. By the end of the week they had been fishing twice, once even catching a fair mess of crappies. They didn't get to eat them though as Chum merely wrapped them in newspaper and left them on the picnic table—he'd clean them first thing in the morning. He didn't have to; a raccoon cleaned them thoroughly, leaving nothing but the skeletons. The kids thought their dad walked funny ever since he had gone horseback riding. Their mother explained that all cowboys walk that way at first. Some things could have been worse, like they didn't have to go into town for chigger bite medicine, the park store carried a supply. Midway in the second week, when they had to break camp and start the trek homeward, they had become fairly well acclimated. They all scratched a lot, but their ruddy complexions looked good—from a distance. Peeling sunburns are never attractive up close. The chigger bites seemed to have been neutralized and Chum's limping was hardly noticeable—or else they were all used to it. Mrs. C. had become resigned to seeing her family in wrinkled clothes and she automatically shook everything she picked up to make sure any bugs would fall out.

Their own driveway—even with the skinned tree across from it—had never looked so good. And their own bed, that was the greatest. Mrs. C. slept and slept and slept. When she did finally get up, around noon, the first thing she did was call the base paper and place an ad. "FOR SALE: Complete set of camping equipment, used less than two weeks. Umbrella tent, bottled gas stove, icechest, folding chairs, much other equipment. Bargain for quick sale." ☆

Major T. J. Slaybaugh

ONE CANDLE FOR A PIECE OF CAKE

Lt Col Frederick C. Blesse, Directorate of Aerospace Safety

On the 4th of February 1964, the F-4 had its first USAF birthday. If the size of the birthday cake were determined by the success of the first year of operation, the cake would stretch from coast to coast. A group of hard working Air Force people in our first USAF F-4 unit have set a precedent with this new fighter—a precedent that should be a challenge to every unit scheduled to receive the F-4.

Our Air Force objective of course is to transform every new unit into a combat organization without the loss of a single pilot or aircraft. The 4453rd CCTS at MacDill AFB, Florida, has proven that it can be done. Maybe by telling their story, by sharing their problems and solutions, their near misses that could have been accidents, the next transitioning unit can do their job just a bit easier and safer. This is my objective.

Training of pilots and maintenance personnel began long before the 4th of February, 1963, but the story I want to tell began on that day. The 4453rd CCTS received the first of twenty-nine F-4B's from the Navy that day to begin the training of all F-4 pilots in the Air Force. The Commander, Colonel F. K. "Pete" Everest, was the first to start training. Other key supervisors and instructors soon followed. Students arrived in the October-November 1963 period and the unbreakable chain of student training began. The rest is history and detail—but such history and detail that other activating units are destined to suffer in comparison unless they take advantage of every piece of information that can be gleaned from the MacDill operation.

By 31 December 1963, the 4453rd CCTS had flown 6491 hours in the Navy F-4B. An additional 124 hours had been flown in the USAF F-4C—a total of 6615 hours. These hours were flown without major or minor accidents in our fastest and most versatile fighter. The F-4 thus became the only high performance fighter in our inventory with a zero accident rate for 1963.

The utilization rate for the first 11 months was 30.9 hours per aircraft. Work continued. A few close calls alerted everyone to the fact that things were not perfect. Procedures changed. Flying hours mounted. By the 30th of April 1964 the unit had flown a total of 11,756 hours in both models of the F-4. This now represented 15 accident free months—all of which involved transition, instrument flying, formation, navigation, air combat maneuvering, missile firing, rocket firing, dive bombing, skip bombing, aerial refueling, and night flying.

The title of this story might fool you. The wonderful handling characteristics of this fighter make it a piece of cake to fly, but achieving such an enviable record for the first year of operation can hardly be attributed to good fortune. Let's see what was responsible. Obviously, some factors were favorable. The better the planning the more of these you will have.

Operational and maintenance personnel were carefully selected when the unit activated. Supply lines were direct from McDonnell Aircraft Corporation rather than through Air Force base supply channels. Much experience was derived from the Navy, which had been operating the aircraft since 1961. McDonnell personnel were on hand to aid in the training of personnel and trouble shooting the aircraft. These were all significant advantages, most of which will not be available to the average unit transitioning from F-84's or F-100's into the F-4C. This doesn't mean it can't be done without these factors; it does mean more careful supervision, more detailed planning may be necessary to come up with the desired result. There were other factors too, some the result of good command practices, some the result of efforts by the engine and aircraft manufacturer, and some just from good fortune.

The squadron established a solid safety program to include foreign object damage (FOD) emphasis (one damaged engine in 15 months operation) and prompt identification of problem areas. The culmination of every unsatisfactory condition was a strong push for corrective action through Operational Hazard Reports (OHR's), etc.

To aid the squadron with their new aircraft an F-4C Operational Engineering Division (OED) team was constantly investigating problems and receiving aid in their solutions from Tactical Air Command headquarters. Such problems as F-4C main wheel bearings, fire warning and overheat system, control of cockpit temperature, wing tip position lights, in-flight refueling, and many others were investigated by this team. The team was of invaluable assistance to the commander.

The performance delivered by the General Electric J-79-8, and -15 engines had a great deal to do with the squadron's success during the first year. Although the -8 and -8A engines showed some evidence of hot section distress during periodic inspections, the characteristic operation of both series engines was trouble free from periodic to periodic. This is a new plateau for high performance engines for fighters and safety-wise is difficult to improve on.

Still another factor that helped make the '63 operation spotless was the unbelievable flight handling characteristics of the F-4. It would be a serious error to overlook the part this feature played in eliminating pilot error accidents. Any century series pilot who has had to cope with the all-weather European operation from 8000 usable feet of runway will understand that comment. No one will argue that the century series birds (170K final approach) we have been flying can be stopped in 5000 or 6000 feet without a drag chute. But mix a crosswind, a pinch of rain and a drag chute failure (and this is easier to find in Europe than a seven in Las Vegas), and that 8000-foot runway can become nine pounds in an 8-pound bag before you know it. The luxury of a 135-knot final approach in a high performance fighter is hard to underestimate.

There are other things, too, that contribute. Twin engine reliability, for instance. Generator failure, CSD failure or any of a dozen critical emergencies in a single engine fighter suddenly become routine when the engine can be shut down and the aircraft returned to the base for maintenance.

It seems that with all those things working for you, any operation could be a huge success. That's probably true providing there were no items on the other side of the scale. Let's have a look at that now because there were some significant factors affecting the squadron adversely.

It was obvious immediately that this aircraft had one thing in common with her century series sisters: she was going to require "around the clock" maintenance if the operation was to be a success. Three 8-hour shifts were formed and that maintenance procedure still exists.

Aerospace Ground Equipment (AGE) was critically short the entire year and, in fact, still is.

Test equipment in some cases was hardly off the drawing boards, to say nothing of being available in the squadron for use.

A new breed of pilot (Pilot Systems Officer—PSO) had to be trained to operate hand in glove with the pilot. Training him to operate the radar and naviga-

LtCol Bill Menaker, Director of Maintenance; Maj Ralph Parr, Operations Officer; LtCol Jerry Hogue, Squadron Commander; Col Ernie Biggs, Director of Operations; LtCol Stud Allen, another Squadron officer, and Col Frank K. "Pete" Everest, Squadron Commander.

tional equipment was not the area where emphasis was needed. These lads were pilots too and regardless of their previous pilot experience (and some of it was extensive) they wanted to fly the aircraft, not ride in the back seat. This problem was dealt with (only time will tell how effectively) by establishing a minimum tour of 200 hours in the F-4 and 500 hours total. He may then enter the pilot training course commensurate with existing vacancies. The responsibilities of the PSO are numerous. He

- plans the mission
- assists the aircraft commander in preflight
- advises maintenance of inflight radar and navigational problems
- preflights and operates navigational equipment
- performs navigation, bombing and radar functions
- pilots the aircraft when necessary
- operates communication equipment
- maintains back seat landing proficiency
- provides inflight relief and emergency assistance as required.

In addition to those rather general problems, others developed with the aircraft that made the possibility of an accident-free year look extremely remote. The first problem was an operational one:

A night checkout with a steep landing approach resulted in two blown tires, extensive damage to fairing gear doors and dents in trailing edge flaps. This easily could have been the first accident, had good fortune not prevailed. The loophole was closed. Final approach glide angle was changed to two and one-half degrees and, in somewhat of a coincidence, a Visual Glide Slope Indicator was installed about that time. No further problems have been encountered in this area.

Minor problems continued to present themselves such as control of cockpit temperature, fog and moisture, wingtip position lights, main wheel bearings, and a score of others.

The next major problem arose, however, when a malfunctioning nose gear steering unit gave a hard-over signal during landing roll-out. Others occurred, giving serious problems of aircraft control from blown tires. The result was the curtailment of formation landings and takeoffs. Unsatisfactory reports were first submitted in June of 1963 on this item but it still remains a problem to the squadron.

Utility Hydraulic System failures occurred with unbearable regularity. More than 40 were recorded. These usually were the result of reservoir seal failures, hydraulically operated fuel transfer pump seal failures, broken lines, and O-ring seal failures in actuators. (Over 30 rudder actuator failures, for example.) Corrective action provided an improved shaft seal in the transfer pump and new reservoir seals (called "Green Tweed" seals). Steel lines replaced aluminum lines; maintenance care and caution was increased during disassembly of struts and actuators.

One utility system failure occurred concurrently with emergency brake failure. Again good fortune prevented an accident. The aircraft, after rolling the entire length of the runway, threaded its way through the runway threshold lights before contacting a runway light control box. Only one flap was damaged. The failure was caused by a leaking seal in the rudder damper actuator. The emergency brake didn't work because the accumulator O-ring seal failed which in turn permitted loss of the pneumatic pre-charge.

Of all the incidents which easily could have resulted in a major accident, those involving clamp bolt failures were the most serious. These T-bolts are used in some 30 to 35 locations throughout the aircraft, many of which are in the fuel and boundary layer control systems. On three separate occasions T-bolt failures in the fuel system were responsible for loss of tremendous amounts of fuel. All three cases, fortunately, occurred on the ground.

Newer bolts manufactured to specification are now available. Where possible substitution of old bolts is in progress. An additional precaution of safety wiring the most critical areas has paid off on several occasions for the Navy. These occurrences make it plain that no picnic was going on in the maintenance area.

Another problem plagued both operation and maintenance. From February through December, 1963, pilots and maintenance personnel were learning to fly and maintain the Navy F-4B. In December, 1963, the C model arrived on the scene. Although a high percentage of items are similar, many significant differences exist in the two models requiring retraining of both pilots and crew chiefs. A few of these were the change from the Dash 8 to the Dash 15 J-79 engine, a pneumatic starter, battery, dual instead of single wire systems on the ignition harness, different hydraulic pumps, different aerial refueling system (boom instead of probe and drogue), larger tires, hydraulic instead of pneumatic emergency brakes, an anti-skid system, diluter demand instead of pressure oxygen system, plus some other changes in electronics and in cockpit arrangement of switches and instruments. Concerning these changes most pilots will agree that:

(1) The battery and cartridge starter are really the

Col Everest insists on careful preflight planning.

answer to some much needed self-sufficiency.

(2) The bigger tires on the C are good. They are tough, durable and dependable. Some tires get as high as 80 landings but the average is about 50 per tire, outstanding when compared to other first line fighters.

(3) The anti-skid system has a bug at present and is undergoing a modification. Its capability to stop the aircraft in 1800 feet in condition for another immediate takeoff has been well demonstrated, and there is little question that its addition augments the tactical capability considerably.

(4) The C brakes appear spongy to most pilots at low speeds. They prefer the pedal pressures on the B.

(5) The emergency brake system on the C is not as good as that on the B model. The B had trapped accumulator pressure for about six applications for directional control. The hand operated control lever beside the seat for both brakes was excellent. Also, in the B, emergency system pressure could be checked by the crew before flight.

Actually the gage should be in the cockpit where the pilot can tell if he has emergency braking pressure in event of a Utility Hydraulic System failure.

(6) The Diluter demand oxygen system on the C is a real delight to the pilot after the pressure system on the B.

(7) The intercom system on the C is much more quiet, far superior.

(8) The refueling receptacle on the C is probably superior but some of the pilots are having trouble getting used to it. They trap the boom in its lower forward limits and damage the receptacle. Also utility hydraulic failure could produce a problem on a deployment since utility pressure is needed to extend the receptacle.

(9) The rear cockpit in the C has some improvements to visibility. Back seat landings are easier. All controls essential to landing are available in the rear cockpit and the instrument layout in back is an improvement. Scope location is not quite as good as on the B.

(10) Inertial platform—more test equipment is required to obtain desired navigational accuracy.

(11) The radio and navigational equipment in the C is not as good in some ways. You have to go through 18 preset positions to get to manual or Guard. Homing or tracking is not possible with the gear down, due to signal distortion. This apparently is caused by the fact that the antenna is too close to the nose gear door.

Capt (now Major) Cliff Allison, Safety Officer.

(12) Bombing system—an excellent layout in rear cockpit. The unit has achieved 100 per cent release reliability during exercises with good bomb scores. Wings should achieve excellent scores with the F-4C.

Obviously, these are unofficial opinions but usage will probably prove them to be fairly accurate.

The squadron faces a move this July which means 1000 personnel will go from MacDill AFB, Fla., to Davis-Monthan AFB, Ariz. Soon after arrival the complement will swell to 1500 as personnel for Wing manning become available. Training is continuing (only one class was cancelled) throughout the move in spite of the fact that by 1 July training was required at both bases. By the end of July, all F-4C's (about 50) will have been transferred and the 4453rd will be a complete unit for the first time since early spring.

The plans for moving the unit are typical of their operation. Every member of the unit was issued maps showing the preferred routes to Davis-Monthan AFB, complete with day and night speed limits in all States and construction areas on the given routes.

In addition, each person received a booklet giving useful data required for the move. A list of just a few reads like this:

Data for transportation of household goods.

Insurance review data.

Readying the family and car tips.

Recommended RON locations plus motel listings and approximate rates.

Speed limits and State driving laws of all States on the route.

Do's and Don'ts for good driving.

Instructions in case of arrival delay.

This is not a complete list but it is complete enough to show what goals a "thinking" organization can strive for to ensure safe arrival of much needed personnel.

Well, that about covers the first year or so of activity. For the 4453rd CCTS it was a year marked by some close calls, each one considered a challenge by a group of dedicated professional officers and pilots. The Squadron was expanded to a Group, and now to a Wing. Their fantastically responsive supply system through McDonnell Aircraft Corp. in St. Louis has become a thing of the past, and all F-4C supplies now must come through AF Base Supply. Some of the highly qualified personnel will soon be filling overseas quotas but others will take their place. They too will be subjected to the exacting demands of Commander "Speedy Pete" and they too will do things they didn't know they could do.

When asked about his record zero accident rate for the first year of F-4 operation, Col Everest's remark, accompanied by a shrug of the shoulders was, "A little work but mostly luck, I guess." After careful consideration I am forced to agree it is pure luck—just like playing the violin. ☆

Simple modification makes chutes steerable,

Better Break on Bai

Aircrewmen forced to bail out are going to get a better break with a new midair parachute modification that will provide better landing characteristics. The new procedure has the man in the parchute cutting four suspension lines. This action can prevent some of the many injuries crewmen have suffered upon or after landing.

The modification was brought about by a Qualitative Operational Requirement (QOR) submitted to Hqs USAF by the Life Sciences Group, DTIG. Concerned by the number of landing injuries (one-third of the major injuries during ejection occur during landing), escape system specialists investigated various parachute configurations used by sport jumpers and U.S. Forest Service fire jumpers. The QOR resulted from these studies.

The parachute modification that is scheduled appears as a revision of T.O. 14D1-2-1 and was developed by the Systems Engineering Group (SEG) of AFSC's Research and Technology Division. The mod provides for identification of the lines to be cut by wrapping a four inch portion of the lines with colored tape. The tape to be used is a waterproof, pressure sensitive adhesive tape of specified red or orange color.

Tests with dummies and live parachutists were performed to develop a modification that would reduce the number of landing injuries and fatalities by providing the parachutist with a means of steering his parachute and lessening oscillations. Of course, there could be no compromise of escapability or reliability. Testing was done with the standard C-9 personnel parachute canopy. Following are some of the conclusions reached:

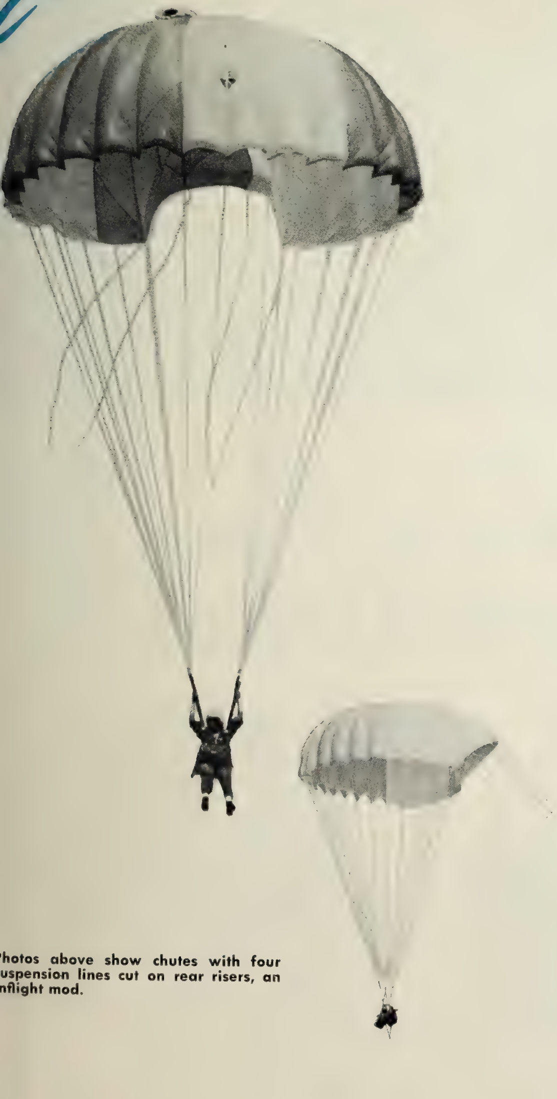
- Improved control results without compromise of overall parachute performance.
- Rate of descent was 2.8 per cent less and oscillations were reduced.
- Since the modification is made during descent, opening characteristics and canopy strength are unaffected.
- A short training film would be of further benefit to aircrews in becoming familiar with the line cutting procedure. (Such a film is under consideration.)

The proposed revision to the technical order includes instructions for the suspension line cutting procedure which, if followed, will permit the parachutist to safely reduce oscillations and steer and turn his canopy. A warning note cautions that the procedure should not be attempted when the parachute opening occurs below 500 feet.

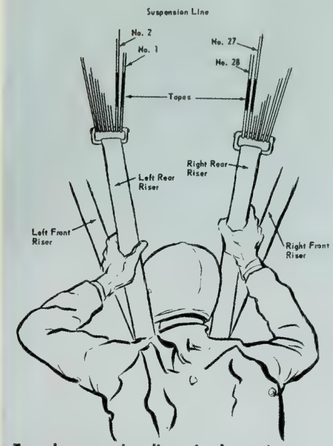
Proposed revision to T.O. 14D1-2-1:

1. Make a knife accessible. The standard hook blade riser knife is recommended when available.
2. Visually locate the lines to be cut.
3. Starting with either rear riser, pull the riser down and grasp the two marked suspension lines with one hand.
4. Holding the knife in your free hand, sever the two marked suspension lines.
5. Repeat steps 3 and 4 on the remaining rear riser to complete the midair canopy modification.
6. The cutting of the four suspension lines will cause a large "lobe" or "scallop" to form in the rear center portion of the canopy skirt.
7. The "lobe" provides a facility for turning the canopy at the approximate rate of 30 degrees per second and will also significantly reduce oscillations.
8. To turn the canopy, grasp the appropriate rear riser (i.e., right rear riser for a right turn and conversely) and pull down. Release the riser when the turn has approached the direction in which you wish to be oriented.
9. The modified canopy will inherently glide in the direction you are facing at a rate of 3 to 4 knots in still air. Use this inherent drift to your best advantage when maneuvering toward a suitable landing area by either increasing or counteracting the drift caused by prevailing winds.
10. Always give yourself time to turn the canopy so that you are facing into the wind for landing, and get this done before you reach 200 feet from the ground so that you are not in an awkward landing attitude. This "upwind landing" permits the inherent canopy glide to counteract the prevailing wind to some degree, and reduces rather than adds (as in a "downwind" landing) to chances of landing injury. ☆

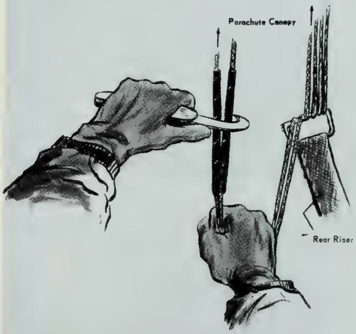
nts oscillations.



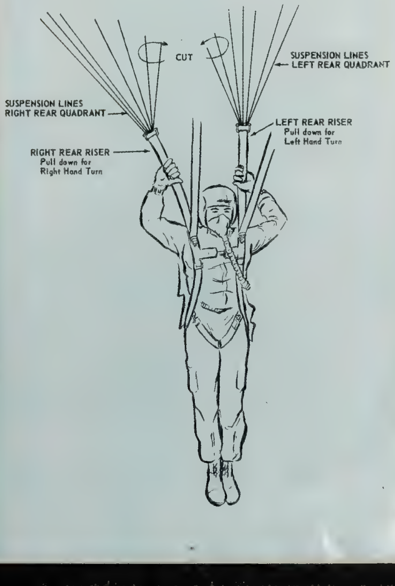
hotos above show chutes with four uspension lines cut on rear risers, an nflight mod.

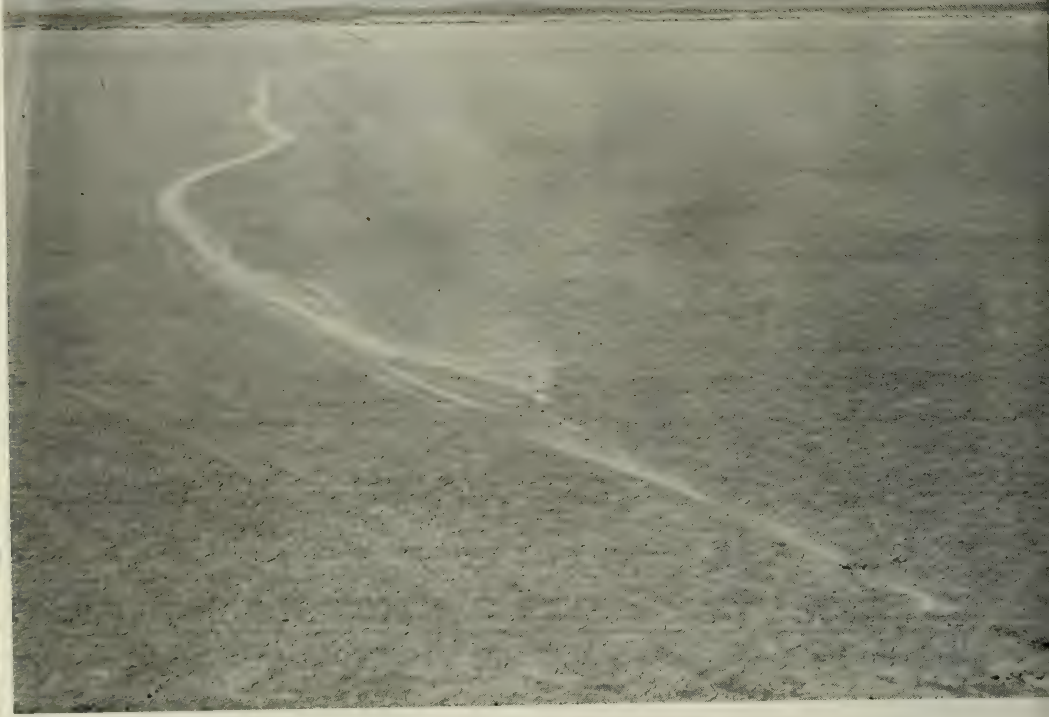


Taped suspension lines (to be cut) are seen above.



Pull down and cut the taped lines on rear risers only.





Two survive low altitude, high speed ejections and . . .

Lake Bed Landings

Worn and bloodied flight suit and flying jacket indicate seriousness of being dragged, even over flat, level area.

Ed. Note: Early this year two fighter pilots were forced to eject when their aircraft went out of control shortly after takoff. The rear seat pilot retained his helmet, but suffered facial injuries when the plastic frame of his oxygen mask shattered. He released his chute immediately upon ground contact. The front seat pilot lost his helmet, was unable to actuate the chute quick release and was dragged approximately 300 yards. Both are now strong exponents of helmet chin straps, workable parachute quick releases and the importance of getting free of the chute immediately upon ground or water contact. Following are the statements they prepared for AEROSPACE SAFETY magazine readers.

REAR SEAT PILOT

I was forced to eject from the rear cockpit very shortly after takeoff. The aircraft had entered a violent roll to the right almost immediately after establishing a climb attitude of 20 degrees nose up with an IAS of approximately 450 knots. After confirming instructions from the pilot to bail out, I initiated the ejection lanyard with both hands. I had previously put my hands on the lanyard and had experienced some difficulty in doing this because of centrifugal forces resulting from the roll rate of the aircraft which I estimate was in excess of 400 degrees per second.

Immediately after pulling the ejection lanyard, I heard the very loud explosion of the thrusters followed by the noise and tremendous force of the wind blast as I left the aircraft. I do not recall any gyrations of my body prior to chute deployment which was actuated by the zero delay lanyard, as it was still connected.

My next problem was separating from the seat. I was not sitting in the seat but it was in some way attached to my right foot. I recall kicking and pushing at the seat with my left foot until it fell away from me. The parachute descent was uneventful — almost pleasant so I took inventory of myself and found that my oxygen mask was gone but my helmet was still on. My eyes and face felt as if they had been burned and my face was bleeding. The burning was associated with the windblast at the time of ejection. Minor cuts were noted on my forehead in the mid line from the shattered plastic frame of the oxygen mask.

As I approached touchdown I was aware of the rapid drift that I was experiencing and recalled the wind velocity of 12 to 15 knots which was given to us at takeoff. I knew I had to get out of the chute as soon as I touched down so I removed the guard on my left quick release and held my right hand on the release which I pressed either just prior to, or upon, touchdown.

I touched down facing the direction of the wind drift but do not recall rolling or falling upon contacting the ground. I had experienced no difficulty in actuating the parachute quick release which I attribute to extensive training necessitated by a considerable amount of over water flying. The rescue helicopter transported me directly to the base hospital. I recall sustaining a marked whiplash type force on my neck. This was due to my head being flexed at the time of ejection.

FRONT SEAT PILOT

A mandatory ejection was dictated by the following circumstances:

a. Aircraft out of control.

b. Flight control system not effective.

c. Descending through approximately 1500 feet.

d. Right wing believed partially missing.

The canopy was not jettisoned prior to ejection because I was unable to reach the handle due to the severity of aircraft roll.

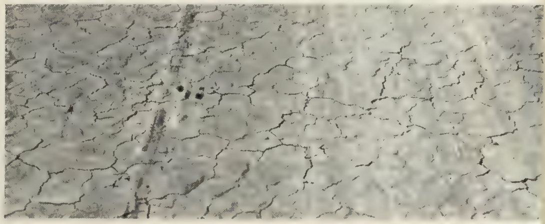
After insuring rear seat vacancy I reached down with both hands and actuated the ejection handle—only the right hand caught the lever. My left hand missed due to, again, the severity of the roll.

I ejected with the zero lanyard hooked and helmet visor down. After ejecting my first recollection was that of attempting to actuate the parachute D-ring. I looked up and saw the chute deployed. I also noted a large obstacle (I think it was the ejection seat) entangled in the shroud lines just above my head. The object dislodged, striking me on the head and then falling away. I put my gloved hand up to where I had been struck and noted blood on the glove. At this time it became obvious I had lost my helmet and mask. I was wearing a Lombard Helmet and MBU-5/P mask. The helmet was without a chin strap.

Just prior to ground contact, I put my right hand on the left parachute release and noted a rather high drift velocity across the lake bed. Upon ground contact, I was rolled over backward. Before I could relocate and activate the parachute release, I was being violently dragged on my stomach. I was unable to reach the parachute release while being dragged.

After several attempts, I was successful in pulling in one set of chute risers, thus collapsing the chute. Once the chute was collapsed, I stood on top of it and took my chute harness off.

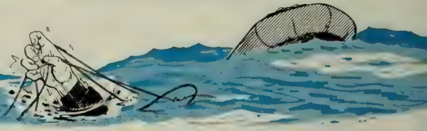
The rescue helicopter was sighted and picked me up momentarily. ☆



Trail across lake bed (opposite page and at right) was made by the pilot. He was dragged approximately 300 yards before he could collapse the chute.

For the past five years, 18 per cent of the aircrewmen who've made water landings found themselves in . . .

Watery Graves



The time sequence went like this:

1415 pilot ejected, aircraft on fire.

1425 pilot in water.

1430 pilot sighted, in life raft.

1445 rescue attempts by two helicopters completed, both unsuccessful.

1450 launch alongside.

1453 pilot aboard launch.

The narrative sequence is a bit more dramatic:

On climbout a heavy fuel leak occurred in the Century Series fighter and fire broke out in the engine compartment. The pilot ejected and went into an undercast. He was first spotted by the crew of one of two searching helicopters. He was in his life raft. By the time the choppers could move in to make the pickup he was in the water, beside his raft. Both sides of his underarm life vest were inflated. A winchman from one of the choppers went into the water and aided the pilot in getting into the sling. Lift was started, pulling both the pilot and the winchman toward the door of the chopper. This operation was normal until the pilot's chute canopy started to clear the water. Drag increased, the pilot slipped out of the sling and fell back into the water. One-half of his life vest was lost at this time.

The second helicopter moved in for a rescue attempt. The pilot had slipped out of his parachute harness. On this lift attempt the pilot only cleared the water a few feet when drag was encountered. He was dropped again. By now both sides of his underwater life preserver had deflated. He hung onto the side of his life raft to remain afloat. The chopper crew now realized that the pilot was still entangled in his chute harness and shroud lines. They prepared to put a man into the water to cut him loose. This plan was abandoned as a rescue launch was approaching. The launch came alongside and the crew threw a line to the pilot.

The pilot grabbed the line, let go of the raft, and immediately sank beneath the surface. Two crewmen from the launch dove into the water, but they could not locate the pilot. Raft, chute and pilot were pulled aboard in that order.

The pilot had drowned. He had not released his quick release, nor had he attempted to cut himself free.

Because of the thin line between life and death in this case, it is more heart-rending than some post-landing fatalities, but it is not an isolated example. A recent Life Sciences report discloses that during the five-year period ending 31 December 1963, a total of 150 parachute water landings were made after bailout and ejection from Air Force aircraft. In 27 cases crewmembers succumbed to effects of post-landing environmental conditions.

From the same study, following are remarks, selected at random, but representative of parchute line entanglements following water landing:

"Before I could say 'Jack Armstrong' completely fouled." Rescue party had to cut lines to pick survivor from water.

"Couldn't swim to dinghy because lines tangled around my legs."

Fishermen had to cut shroud lines to recover body.

Feet entangled in shroud lines, extreme difficulty, pulled from the dinghy, almost drowned during rescue as parachute caught in ship, had to be cut loose.

Had to cut lines off with survival knife.

Completely entwined by shroud lines, great difficulty.

Missing, observed in normal descent with equipment deployed, last seen climbing into dinghy. Possible entanglement.

"The more I moved and cut the more I became entangled."

Pilot was found entangled in shroud lines of his own and radar observer's chute.

Entire entanglement of chute and lines around pilot's legs, both feet, ankles and legs tightly bound. Drowned.

The reason for relating the one experience, and briefs of others is, of course, to emphasize the seriousness of this problem. It was further underscored during the making of the parachute film, "Passport to Safety." On two occasions professional parachutists (also experienced in SCUBA diving) became helplessly entangled in sinking suspension lines in a matter of seconds following water landings, and had to be rescued by standby safety personnel.

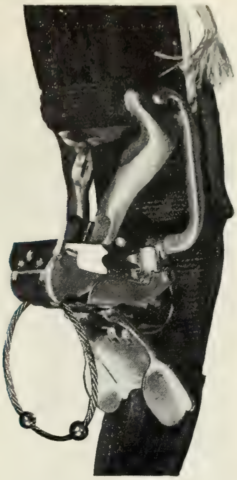
The problem is well documented. What should crewmembers do to ensure their chances, should they ever be required to make an overwater bailout or ejection? Two things: First, they must fully understand and practice in order to immediately release the canopy upon water contact. The parachutist must give the canopy every opportunity to drift beyond him before it hits the water Second, always carry the knife know where it is, how to get at i quickly and how to use it. Best o all, go through a water landing survival school such as the one TA conducts at Langley AFB.

These are also good tips for anyone having to make a parachut landing on land (Ref: Lake Be Landings, page 16).

This problem continues to be major concern, Air Force-wide Chutes are being modified with a improved canopy quick releas (page 19) and a method of treat ment of parachute suspension line and canopies with a solution to mak them waterproof is under stud Members of DTIG Safety hav conducted a preliminary test b comparing floatability of standar suspension lines treated with a com mercial water repellant and u treated lines. The untreated line sank quickly while the treated lin remained afloat indefinitely.

As has been well documented the Air Force, survival after par chute water landings is a maj problem. For anyone facing such situation knowledge of prese equipment and prompt action is a solutely essential. ☆

NEW MODEL Canopy Release



As an old familiar saying goes, "Everybody talks about it but nobody DOES anything about it." This has generally been applied to the weather, but the saying has had particular application to the present canopy release on our parachutes.

Most vociferous, and understandably so, have been those who were dragged across the ground or anchored to a soggy chute and five miles of risers in water. Their complaints about the release have been both bitter and valid. Now, however, the talk is over and somebody has done something about this equipment. A modification kit including tools has been developed along with modification data for use by base level activities in converting releases in service. According to MAAMA, kit delivery will start this month and should be completed by December, 1964. Surveillance will be maintained for ways to improve the delivery schedule when possible.

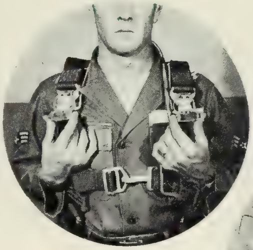
The new release is essentially the same as the old one but with one big difference: operation has been changed from a "squeeze and pull" to simply a "pull" operation. The squeeze buttons have been eliminated and replaced with a cable. Here's how it works:

Unsnap the safety guard in the usual manner. This frees a cable loop that is stowed under the guard and acts as its own spring to pop into prominent position for the next release action. A sharp tug on the cable loop with one or two hooked fingers causes the latch arm to swing out and down. This releases the canopy.

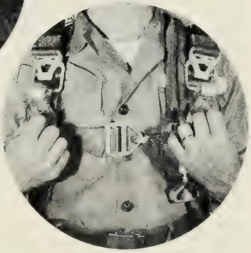
ASD gives the following instructions for three possible landing situations.

- GROUND LANDING. Unless there is a very high ground wind (more than 15 knots) do not touch the canopy releases before reaching the ground.
- IN HIGH WIND. Immediately after ground impact release one riser group by operating the canopy release (use either release, usually one release is sufficient to spill the canopy). If there is a high ground wind (15 knots plus) remove the safety guard from one release while you're 200-500 feet above the ground. After that don't touch the release until your feet touch the ground. Then actuate the release from which you've removed the guard; follow through with the other release to make sure the canopy spills.
- LANDING IN WATER. At about 200 to 500 feet above the water, remove one or both safety guards from the releases. Don't move hands or arms around the releases any more than necessary until your feet touch the water. Then pull and follow through. ☆

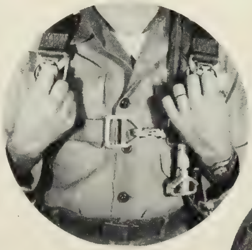
Systems Engineering Group, AFSC



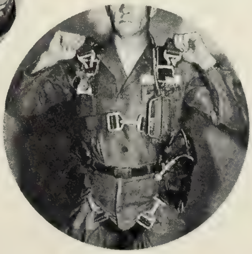
1. Step Nr 1 is to unsnap the safety guard in the normal manner.



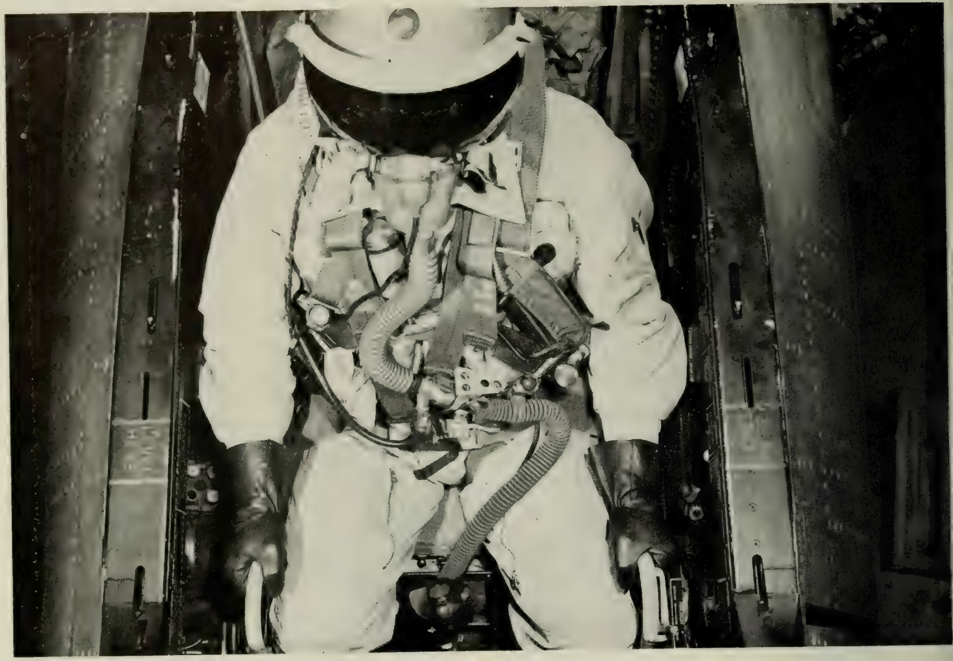
2. Next, slip one or two fingers through the cable loop as shown.



3. A sharp tug will cause the latch arm to swing out and down.



4. The canopy is now released. Either release will spill the chute.



There are exactly 100 reasons why this article is being written.

In the three-year period, 1961 through 1963, there were an even 100 Air Force crewmembers who ejected and died.

We can do better. Seventeen per cent of the ejectees didn't have to die. The 21 per cent of those who survived shouldn't have received major injuries.

If you don't remember anything else from this article, here is one tip you should remember above all else: never eject below Dash One specified altitudes if this can be avoided. Of the 100 who didn't make it during the past three years, over half tried it from 500 feet or less. Now note the following facts: ten years ago the success rate was 79 per cent; five years ago it was up to 88 per cent—the highest ever. In 1963 two significant things happened: there was an increase in the number of low level escape attempts and the success rate dropped to 80 per cent.

Since low altitude punchouts are the number one ejection killer, and since more were tried last year, additional explanation would appear to be in order. Both in 1958 (another year with a success rate reversal) and in 1963 the increased incidence of low level ejection attempts may be directly related to the availability of equipment designed to enhance low level ejection success. In 1958 it was automatic parachutes, automatic lap belts and the zero second deployment lanyard. In 1963 it was the rocket boosted ejection system. It is possible that the publicized capabilities of these innovations influenced crewmembers to stay with their aircraft until conditions were such that survival was doubtful.

As of today, even with the latest type rocket assist seat in Air Force aircraft, *there is no true zero-zero capability*. A forward speed of 80 to 160 knots, depending upon the system, is still required for successful completion of the ejection sequence

In an emergency requiring ejection the crewmember often mus make a marginal attempt, for whic he is not criticized. However, there are too many cases where ejectio was delayed to a low altitude. An the accompanying high fatality rate in such cases warrants the reminder

In contrast with the poor low altitude success rate, high altitud ejections have not proven to b nearly as hazardous. Four fatalities occurred out of 37 ejection above 20,000 feet.

Acquisition of faster aircraft ha not resulted in higher ejectio speeds. Of the total number of ejections for which speed was reporte 95 per cent were below 400 knots

Difficulties during ejection occurred in approximately 30 per cen of the cases. These can be categorized as difficulties occurring befor ejection, and those after ejectio

Because, last year, one out of five who ejected didn't make it, we present basic ejection do's and don't's in an article titled . . .

PUNCH OUT PROGRESS

Difficulty in locating and operating ejection controls and a lack of time were the major pre-ejection problems. Frequent and realistic training is the best cure immediately available here.

Seat-chute entanglement and holding onto seat actuating controls were the most often reported post ejection problems. Post ejection difficulties have continued to decrease, with the seat-man separators thought to be a major contributor. In 15 cases automatic lap belt failures or difficulties were encountered. Damage to the mechanism during the initial ejection sequence or early, inadvertent actuation of the manual release were the cause factors.

Now, post ejection. Of those who ejected successfully, 21 per cent suffered major injuries. Over half of these injuries were fractures. Most hazardous is the parachute landing phase. Training would also appear to be the greatest single antidote to post ejection problems.

Violent ground or water contact, usually after low level escape, is the single major cause of fatalities, accounting for 73 of the 100 during the three year period of this survey. Eighteen drowned or are missing following over-water ejection. Five were fatally injured as a result of striking aircraft parts or debris. Three were lost when dragged in rugged terrain by high surface winds. One presumably succumbed to high "Q" forces.

Worth of the zero second lanyard continues to be demonstrated in Air Force equipment. In general, ejections below 1000 feet with the lanyard engaged were 60 per cent successful as compared to 20 per cent when the lanyard was not attached. There were no fatalities in ejections above 10,000 feet with the lanyard attached.

Rocket powered ejection seat experience deserves special mention. More and more USAF aircraft are being equipped with this system and last year 42 ejections were made using it. We know that this is not the cure-all for the escape problem. Total rocket ejections have been 76 per cent successful as compared to an 85 per cent success rate for ballistic systems. However, in the low altitude regime (below 500 feet) rocket ejections had a higher success percentage (36 to 31). As was pointed out earlier, the success rate in the below-500-foot category is far from satisfactory. Admittedly, the majority of the fatalities were the result of ejection attempted under extremely marginal, if not impossible conditions. Few, if any, reflected adversely on a system meeting its design capabilities, but they do underscore the fact that the systems now in use are not capable of successfully extricating aircrewmen from some emergency conditions they face. Indicative of possible undue confidence is the fact that approximately two and one-half times as many low level (below 500 feet) attempts were made with the rocket system as with the ballistic system.

During the three-year period 38 bailouts were made from non-jet aircraft and 37 of these were successful. Of the conventional bailouts from jet aircraft, 40 per cent were unsuccessful. Almost invariably such bailouts are from jet bombers that are in severe, uncontrollable conditions. Under such circumstances difficulty and delay is experienced in clearing the aircraft as well as a greater probability of striking aircraft structures.

In summary, the largest single cause of ejection fatalities is the result of attempts beyond the performance envelope of existing systems, i.e., low altitude, low air speed and unfavorable attitude. The second leading cause of fatalities is the inability to survive water landings.

Low level ejection with rocket powered systems is more successful than with ballistic systems, but the margin is not as great as had been expected. Further refinement as well as more stringent aircrew education and training is indicated.

Credit: This article was adapted from a report on USAF Ejection Experience prepared by DTIG Life Scientists, Robert H. Shannon and Samuel P. Chunn, Major, USAF (MC). ☆

The pilot is dead now.
Probably no one knows for certain why, but here's the story. Draw your own conclusions . . .

WHY?

Robert L. Terneuzen, FAA Liaison Officer
Directorate of Aerospace Safety

Takeoff from the midwestern base was routine. As the pilot of the fighter settled down to the relatively short hop ahead, everything apparently checked okay. After about 30 minutes of flight, at 2145Z, he received 2058Z destination weather: estimated 2500 broken, visibility seven miles, wind 240 degrees at eight knots, altimeter 29.07. A few minutes later he was in contact with the center nearest his destination, which advised they had radar contact and would have a clearance any time he wanted to start descent.

At 2208Z the flight was given a clearance to descend from FL 330 to 210; the pilot acknowledged and was advised that the altimeter setting of 29.07 was very low. The controller then asked if the pilot wanted an "enroute descent or a penetration." The reply was, "I'll take a radar controlled penetration."

Controller: "You want an enroute descent straight in. Is that right?"

Pilot: "Affirm."

It was now 2214Z as the aircraft began a decent to 5000 feet. Another altimeter setting was issued as 29.04.

Again the pilot acknowledged.

Now the Center controller began his verbal coordination with approach control, determining between them the point that would be used for the radar hand-off and the type approach to be conducted. A new heading and clearance to the local VOR were given to the pilot with the two controllers again coordinating. The pilot reported "Passing through 6000 feet and I'm TACAN only." The controller acknowledged the transmission but evidently missed that portion of the transmission about "TACAN only."

The radar hand-off was completed to approach control at 2218Z; however, the controller was unable to receive the pilot's transmissions for two minutes. The pilot responded to clearances by complying with requested turns. At 2220Z the pilot's transmissions were again received normally whereupon the flight was descended to 1500 feet.

The clearance issued by approach control was, "This will be a vector to VOR final approach course, runway three-three, straight-in approach." The weather was also given as, "Estimated ceiling two thousand broken, four thousand overcast, visibility two miles, light rain, wind three three zero variable to three zero zero degrees at niner. Altimeter is two niner zero three."

Again the pilot acknowledged and repeated the altimeter setting.

At this point the controller transmitted, "I will advise you when you are at the five nautical mile radar fix on your approach so you can continue descent to the minimums."

Additional headings were given to vector the flight to an intercept heading of the inbound course. Finally when eight miles from the runway, the pilot was advised of his position with reference to the inbound course and was cleared for a straight-in VOR approach. The controller stated, "You should intercept the one three eight degree radial approximately now."

At 2224Z the aircraft reached the five nautical mile radar fix at which time the controller stated, "Passing the five nautical mile radar fix slightly right of course," then cleared the flight to land. The pilot acknowledged with, "Roger." Again the controller cleared the flight to land and again the pilot rogered. No further transmissions were received from the flight.

At 2226Z the tower controller ob-

served a large ball of fire appear approximately two and one-half miles from the field as the aircraft struck the ground.

What went wrong?

By starting at the beginning it was learned that the pilot failed to insert "TACAN only" in the "remarks" section of his 175. Small point? Perhaps, but this omission caused ATC to be unaware of the NAV limitations of the aircraft. Another incidental point, the controller failed to hear the pilot when he reported this fact.

When the VOR approach clearance was delivered, the pilot did not question the controller. Should he have requested a TACAN approach, complete radar approach, or at least advised ATC that he had no plate for the VOR? (The VOR approach was not published in the JAL Handbook.)

Radio acknowledgments by the pilot were prompt and conveyed no apparent apprehension. The controller may have instilled a feeling of security in the pilot through his transmission concerning "enroute descent straight in," leading the pilot to believe this was to be a radar vector, descent and approach to the airport. Actually a Radar Enroute Penetration can terminate in a number of ways, such as complete GCA o the runway, surveillance radar approach to within a mile of either the nstrument runway or other designated airport runways or it could also terminate, as in this case, with he aircraft on an interception headng to the final approach radial of he VOR.

Now, effective May 28, aircraft on an IFR flight plan may be radar vecored to a position in VFR weather o the airport traffic pattern. (See box this page.) This information will be included in an amendment o the Flight Information Manual.

This particular air base was not equipped with precision radar; however, the JAL Handbook stated, "RADAR AVAILABLE," as it does for all air bases having radar. The term applies to both precision and/or surveillance radar, again misleading the pilot.

Witnesses stated that the aircraft was low at 12 miles out on final (estimated 700-800 feet above the ground) and that it was extremely ow when it passed over a house bout one mile from impact.

An attempt was made to re-create the final portion of flight by flying a T-33 over the course with the altimeter set to an equivalent of 30.03 at the time the aircraft crashed. This placed the test aircraft 900 feet low.

One of the witnesses who observed the fighter also observed the T-33. He stated the two altitudes were about the same.

How about radar? The test aircraft was flown to within 50 feet of the trees with two accident investigators watching the scope. The radar return was normal for a T-33. Other tests indicated that the aircraft could have been flying 800-900 feet low and still show a normal radar return.

Although the primary cause of this fatal accident was concluded to be pilot factor in that the pilot misset the altimeter, there are other factors needing correction through better procedures or pilot education. For example, we're working on improving the JAL Handbook and informing pilots of the importance of using the "remarks" section of the 175.

Low altimeter settings will continue to exist and all that can be done is to alert pilots when these occur. The pilot in this story was alerted on more than one occasion during his approach, yet it was found that witnesses testified to the extremely low altitude of the aircraft when still several miles from the airport. Check your altimeter. It's possible that this pilot mis-set the instrument to 30.03. It wouldn't be the first time this has happened. Perhaps it's happened to you! (Investigators were unable to determine the actual setting due to instrument destruction.)

Past investigations have revealed the importance of inserting "TACAN ONLY" in the "remarks" section of the DD-175. This information will be passed on by Base Ops to the FAA Center and they in turn will see that this information reaches the final air traffic facility which will insure the assignment of the proper approach procedure regarding your flight.

Check the Enroute Supplement NOTAMs prior to takeoff to be certain of the radar capability at your destination (PAR or ASR).

Last but by no means least—understand the controller's intention regarding your approach and the procedure to be used.

When in doubt, VERIFY.

RADAR VECTORS IN VFR WEATHER

Effective May 28, 1964, IFR aircraft may be descended to the minimum vectoring altitude and vectored to a position in the airport traffic pattern whenever the ceiling is at least 500 feet above the minimum vectoring altitude and the visibility is at least three miles. This procedure will afford a more expeditious service to arriving aircraft and preclude unnecessary vectoring to the final approach fix to a published instrument approach procedure.

1. Pilots will be advised of the purpose of the vector in the following manner:

"Depart (fix), or Turn Right/Left Heading (degrees) for Vector to Runway (runway number) Traffic Pattern."

2. Radar separation will be provided between IFR aircraft until the aircraft are in sight of the tower controller and transfer of control jurisdiction is completed.

3. Prior to being changed to the tower frequency, pilots will be advised of their position with respect to the airport.

The provisions of paragraphs 2 and 3 will not apply when:

1. An IFR aircraft, not yet in sight of the tower controller, is positioned behind another arriving aircraft which the pilot reports sighting, and

2. He is instructed to follow that aircraft and is cleared for a "visual approach."

With a "visual approach" clearance, the pilot operating on an IFR flight plan in VFR conditions may deviate from the prescribed instrument approach procedure and proceed to the airport with visual reference to the surface. Radar service will be terminated when aircraft are told to contact the tower. The tower will assign a landing sequence number.

The following article expresses some thoughts by Colonel George T. Buck, Chief, Missile Safety Division, as he prepared to leave for his new assignment as Chief, Research and Technology Laboratory, Wright-Patterson AFB, Ohio

MISSILE SAFETY COME

I vividly recall a colonel friend of mine asking if I thought a Missile Safety effort as a distinct entity within the Air Force were really necessary. This occurred in mid-1959, just after General LeMay had issued a directive to the Inspector General Group to organize such an effort. I thought it necessary then, and I am more convinced now after working in this endeavor for the past five years. Today, I believe Missile Safety has come of age and can take its proper place alongside the older safety organizations.

Missile safety, as is true of other elements of Aerospace Safety, is not a job to be left to the professional safety people alone—operation of a successful program requires the wholehearted cooperation of everyone involved in any portion of the life cycle of a missile system. In particular, it is important that a concerted effort be made during the design phase of any system to identify safety goals and see that the means to meet these goals are incorporated into the initial design. One of the tools with which to accomplish this has been provided in MIL S38130. It is gratifying that Systems Command is beginning to use MIL S38130 in negotiating contracts for new systems; we hope this use will continue and increase.

Organized safety inputs to the Category I, II and III test plans are now established procedures and are paying dividends. Test procedures are being evaluated from a safety viewpoint and in many cases, tests are designed to prove the validity of safety procedures and the usefulness of safety items of hardware.

Technical data have been improved tremendously over the past few years. But there are still some relatively serious shortcomings and occasionally omissions are uncovered.

Using commands have, for the most part, well organized and smooth functioning missile safety organizations. Air Training Command has incorporated safety indoctrination into missile courses and the Logistics Command is beginning to organize an effective missile safety effort in the support role.

All told, a great deal of progress in the field of missile safety has been made over the past few years. From here on in, it would appear that continued emphasis on, and a gradual refinement of, the program is in order throughout the Air Force.

As a parting shot, I would like to discuss three aspects of the USAF Missile Safety Program which I believe require additional command attention. Not necessarily in order of importance, these are technical data, training, and the unit missile safety officer's role.

Perhaps more than with any previous military weapon, the introduction of missiles into the Air Force weapons inventory has underscored the need for clear, concise and explicit instructions to the operator and maintenance personnel. It is of paramount importance that maintenance technicians and operators understand, precisely as the writer intended, those procedures spelled out in the technical data. Commanders and safety staffs and airmen should review critical portions of technical orders to insure that misunderstanding is not likely.

Technical data should be screened for completeness; omissions are dangerous and can cause catastrophic results. For example, as of a year ago, the technical data for countdown (PLX) of an Atlas F contained instructions to abort the countdown if the gaseous oxygen (GOX) content exceeded the upper limit. This seems clear enough, but there were no instructions in the T.O. as to whether a PLX could be run with the GOX detectors inoperative.

Some crews had concluded that if the GOX detectors were operative, and the content exceeded the upper limit, they would have to abort, but if the GOX detector were not operative and the GOX content were unknown, they should proceed.

This situation, of course, has since been corrected, but it serves to illustrate the type of omission that can spell trouble.

Training of maintenance and operator personnel requires continued emphasis. Missile systems are so sophisticated and complex that no one person will ever completely know all the many sub-systems and support equipment. Critical systems, those whose malfunction will surely have catastrophic results, can and must be understood thoroughly. Training in the realm of trouble-shooting should be accomplished on a continuing basis.

In most missile systems, it is impractical, if not impossible, to introduce malfunctions for the purpose of training on operational systems. However, skull sessions and blackboard talks will certainly fill a large part of this need. Every unit and crew commander should know in detail the consequences of any action he takes and the probable effect it will have on the failure of any of the critical systems. There are many cases on record to indicate that incorrect analysis of a failure was made, or that improper action was

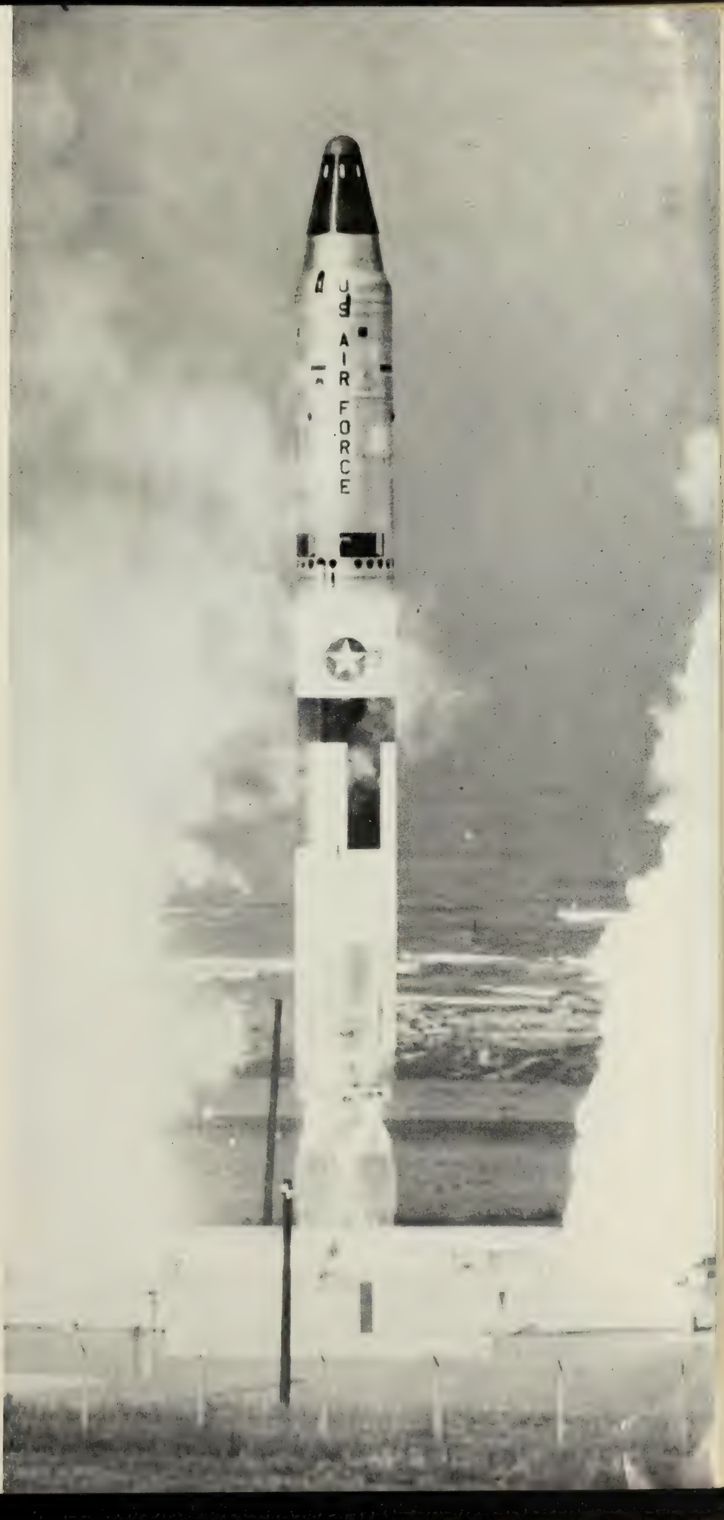
OF AGE

aken simply because the crew or
naintenance technician did not thor-
ughly understand the system.

Then, there is always the indi-
idual who will attempt to perform
job on a missile system by tak-
ng short cuts; in most cases, he
oes this because he does not under-
tand why the tech data require cer-
ain steps. Lack of proper training,
iscipline, or shortcomings in the
ech data are usually the reason. The
ame individual will follow mainte-
ance instructions to the letter when
vorking on his own pet hot rod—
e must be made to do so when
vorking on missile systems!

The commander's right-hand man
s his unit Missile Safety Officer who
ssists him in carrying out the
afety responsibilities. If the MSO
s not used by the commander—if
e is not given the necessary au-
hority and does not have access to
he commander—he will gradually
ecede into the background and be-
ome ineffective. When this hap-
ens, the commander has just issued
n engraved invitation to disaster.
'his is not to say that the MSO
hould be giving operations-type
rders (except in rare critical cases
greed on by the commander), but
ne commander should certainly re-
uire his advice before making deci-
ions that will have significant
afety overtones.

The commander who takes a seri-
us interest in what his safety officer
s doing and how he is going about
is job will seldom have serious
afety problems. The professional
afety people are doing their best to
ee that the mission can be accom-
lished in the safest manner possi-
le, consistent with operational re-
uirements. ☆



Aerobits

Planning a cross-country flight? Like to have transient aircraft maintenance meet you on arrival? You better check the TRANSIENT MAINTENANCE hours of operation at USAF bases listed in the Enroute-Supplement, Flight Information Publication. Why? Well, after many years of providing around-the-clock transient aircraft maintenance capability at most all USAF bases, Headquarters USAF took a look at the actual transient arrivals.

The facts were rather startling. Two hundred and one bases around the world are listed as having USAF operations. Sixty-three per cent of all these bases did not have more than one transient aircraft a day between 2400-0800. Thirty-three per cent of the bases did not have more than one transient aircraft a day between 1700-2400. Manpower authorizations were being provided to insure a minimum of three transient aircraft maintenance personnel on duty for an around-the-clock capability at all but some Continental Air Command and Air Training Command bases.

It was also found that the bases receiving a large number of transient aircraft were short manpower to provide adequate maintenance support. A new standard for transient aircraft maintenance was developed to match the workload with manpower requirements.

New Transient Aircraft Maintenance Base Designations that became effective 1 April 1964 were:

Transient Maintenance Status

No transient aircraft maintenance available (27 bases).

Transient aircraft maintenance available 0800-1700L, Monday through Friday (17 bases).

Transient aircraft maintenance available 0800-1700L (31 bases).

Transient aircraft maintenance available 0800-2400L (47 bases).

Unrestricted transient maintenance (79 bases).

So what does this mean? It means you should receive better maintenance at all unrestricted bases because they have been authorized more maintenance personnel for your support. Bases restricted to certain hours of operation will be supporting your maintenance requirements only during these designated hours. The restrictions apply only to transient aircraft maintenance support (parking, fire guard, maintenance). The tower, runway, crash-rescue, etc., will remain in operation. If you land at a base during the hours transient aircraft maintenance is closed down, you will be responsible for the safe taxiing and parking of your aircraft in compliance with AFR 62-10 in the same manner you would if landing at a civilian field without USAF transien aircraft maintenance support. You ca still obtain fuel, but you or your crew will be required to do the servicing. Regularly scheduled transport aircraft supported by MATS enroute maintenance activities, aircraft on known maneuvers o aircraft operating with prior approval o the base concerned are not affected.

So, be sure to check the Transien Maintenance Status in the Flip Enroute-Supplement for your intended destination. Chances are it won't be restricted. If it is, you had better pick another and enjoy the transient maintenanc service.

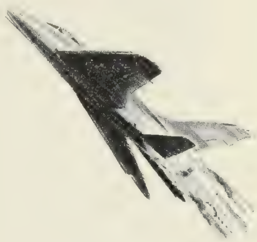
Maj. Thomas J. Barr Hq. USAF

FIRE DETECTOR PERFORM-
.NCE. False fire warning statistics, ob-
ined from FAA data, disclose consid-
rable variance—both by type equipment
nd operators. Examination by individ-
al airplane types and individual opera-
r records shows that false alarms vary
om more than one per airplane down to
ne per 20 airplanes.

How can we get better perform-
nce from our fire detector? First, defi-
iencies in the installation must be cor-
ected. In the case of the continuous de-
ector, the sensing element and its con-
ecting wire must be arranged so that it
ill not chafe on nearby structure; it
ust be out of the way of frequent main-
enance activity, and it must be properly
upported so it will not break. Second,
nce the element routing and mounting
re properly established, they must be
aintained. The sensing element and con-
ecting wires must be inspected at frequent intervals for damage or for evidence of chafing. Third, failures will occur, even though, we hope, rarely. Effective trouble-shooting techniques must be established to prevent one failure from causing multiple false alarms. There is a case on record of 19 false alarms on the same engine detector system in a two-month period—18 of them should have been prevented by effective trouble-shooting.

I realize that trouble-shooting for detector system faults is difficult, especially when they are frequently intermittent; and I realize there are many systems in the airplane for the technicians to master, but we are talking about eliminating false fire warnings because they are a threat to flight safety. Can we do less than to keep hammering away at the do's and don't's of proper maintenance?

Roger B. Jones
Kidde Aero-Space Division



PROPER ROTATION PROCEDURE—On takeoff roll, the pilot rotated the T-39 at the precomputed rotation speed of 112 knots. Takeoff speed had been computed at 126 knots. At approximately 130 knots the pilot thought the aircraft was airborne and he applied brakes prior to gear retraction. The tires were still in contact with the runway, resulting in a left blown tire and scrubbing of the right tire. Rubber coming off the left tire bent the left gear actuating arm and caused slight skin damage to the panel back of the left wheel well.

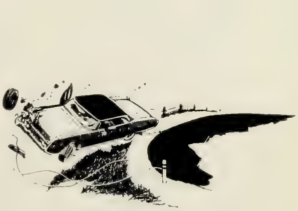
All T-39 pilots at that base have been counseled on proper rotation procedure. Also, the base has recommended a change in the Dash One that would require cross reference with the vertical speed indicator to determine that the aircraft is airborne with a positive rate of climb prior to retraction.

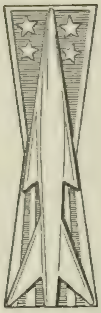
THE PRICE IS HIGH—The party
roke up about 0230 in the morning. The
x airmen had had a big time dancing
nd drinking it up, now it was time to
et back to the base. They climbed into
ie old convertible parked outside, be-
onging to one of their group, a 19-year-
ld airman. The car was later determined
) have been generally in serviceable con-
ition, however it had no seat belts and
ie speedometer didn't work.

One of the group asked the driver how
e felt. "All right," was the reply. They
rove down the road to the main high-
ay, turned left and continued on their
ay back to base. At a point where the
oad begins to curve slightly to the left,
ie driver steered into the left lane of the
eastbound side of the divided highway then drifted toward the right side of the road allowing the wheels of the car to strike the right curb.

The vehicle, going about 60 mph, jumped the curb, proceeded upright along the grass for 116 feet, re-entered the road and started rolling over. It tumbled 352 feet, finally stopping against the left curb. Three airmen, including the driver, were dead, the other three seriously injured. Two of the men were trapped in the wreckage, the others thrown out. Investigators found that the driver was driving at excessive speed while

- Fatigued
- Under the influence of alcohol. ☆





MISSILANEA

AGM-12B COMMAND LINK AND POWER-ON CHECKS—A recent AGM-12B incident and investigation verified the importance of the command link and power-on ground checks. The involved aircraft had completed several consecutive successful missions when it suddenly could not pass a command link check. The pilot aborted the mission and returned to home base.

Ground checks revealed a low output on the transmitter, but the system passed all function checks. The aircraft transmitter antenna was replaced and the aircraft launched on another mission. Again the command link check was failed. On return from this mission, the systems were checked with the engine running and "everything seemed to fail."

Careful tracing of the aircraft's missile control system revealed the cause to be a loose fuse receptacle (115vAC-F503-66; Panel #81 on the F-100F). The command link check averted launching a missile which could not have been controlled by the malfunctioning aircraft system. The power-on ground check substantially aided in duplication, isolation, and correction of the problem. The value of these checks is again proven.

Major H. M. Butler
Directorate of Aerospace Safety

EXCUSES! EXCUSES! Human nature is such that all of us will invariably attempt to excuse away our shortcomings or actions. Take the Surgeon General's recent report on the effects of smoking. Some people have undoubtedly quit smoking as a result of the report. Many others will continue smoking and rationalize this habit by saying, "Well, if I quit, I'll put on weight," or "I'm not a heavy smoker and besides, I'm not convinced that what they say is true," or "I'll switch to a pipe or cigars and reduce the hazard." The same type of excuses frequently appear in missile mishap reports when the individual or supervisor involved attempts to give reasons for the mishap.

Let's assume that a missile operation is not covered by the technical order or that the existing procedure is considered inadequate. A good supervisor will take a close look at the operation and if an SOP is considered necessary, he'll publish one; if the existing procedure is inadequate, he'll submit an AFTO 22 to change it; if the required operation is not considered safe with the current equipment design, he'll take action to have the equipment modified. He will *not* sit twiddling his thumbs over his coffee cup, hoping nothing will happen.

How nice it would be if all supervisors actually responded in this manner. However, past experience indicates that this is not the case. Frequently, no evaluation is made of a new task. As long as no problems are encountered in the performance of the task, little or no action is taken to correct an existing deficiency. No SOPs are written. No proposed changes are made to the Tech Order. But the moment a mishap occurs, the cry of "Tech Data Deficiency" or "Design Deficiency" immediately echoes across the missile complex.

Granted, there are times when tech data and design deficiencies are really the culprits, and corrective action should be taken immediately. However, too often the cry is a shallow attempt to rationalize or create a smoke screen for action that should have been taken.

Put yourself in the position of a supervisor in whose section a mishap has just occurred. For six months your troops have been performing an operation which was not covered by a technical order or a local SOP. When the commander visits your section, as most of them do when trouble occurs, you tell him that the cause of the mishap was technical order deficiency with design deficiency as a contributing factor. He looks you right in the eye and the conversation goes something like this:

"How long has the operation been performed in this manner?"

"Six months, sir."

"Has any corrective action ever been taken to remedy the problem?"

"No, sir," is your meek reply.

"Was the operation evaluated for safety consideration prior to being put into effect?"

"Well, sir, I didn't think it was hazardous and the troops looked like they knew what they were doing."

The next logical question is, "Well, if the cause factors of T.O. and design deficiency are so obvious now after the mishap has occurred, why were they not equally obvious at some previous time—like the first time you did it without a hitch?"

"Well, sir, I guess we overlooked it at the time and besides, I'm not the regular crew chief."

The deeper he probes, the more embarrassing it gets. Finally, after you have sweat about 20 pounds and developed the first signs of ulcers, the boss nails the coffin shut with this remark: "Looks like a case of supervisory error—not T.O. or design deficiency!"

At this point you wish that you were on that slow boat to Viet Nam.

Some of you supervisors may be sitting back on your upholstered office chairs—with medium pressure on the chest buttons of your shirt—thinking "This has never happened to me." But, can all the activities in your section successfully survive the close scrutiny of an irate commander or investigating officer or board?

Let's quit making excuses after the fact and take corrective action before the fact!

Lt Col John A. Worhach
Directorate of Aerospace Safety

WELL DONE

1ST LT. HOWARD J. BEAR

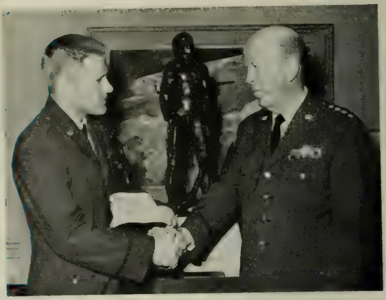
558 TACTICAL FIGHTER SQUADRON. MacDILL AIR FORCE BASE, FLA

First Lieutenant Howard J. Bear was flying one of three F-84s in formation on a cross country navigation training mission. Forty minutes after departing Wright-Patterson AFB, Lt Bear experienced complete loss of hydraulic pressure. He immediately shut off the spoilers and pneumatic compressor to reduce the load on the system and notified his flight leader of the emergency. After initiating a left turn at 22,000 feet for return to Patterson, he declared an emergency with Patterson tower and was cleared to approach runway 05L. When at approximately 15 miles out, an emergency gear extension was accomplished and a safe indication received. Shortly afterward, the aircraft lost power pressure and the emergency hydraulic system was actuated; however, in a few seconds this system also failed, causing the control stick to freeze in neutral. Lt Bear immediately realized that ejection over the heavily populated Dayton area could be disastrous and elected to remain with his crippled aircraft. With conventional rudder the only control available, he maneuvered the F-84F to a successful landing without flaps or speed-boards. Despite a high-speed touchdown, the drag chute was successfully deployed, bringing the aircraft to a stop without damage.

To Lt Bear, for his professional handling of an emergency situation, his skillful control of a disabled aircraft, and utmost regard for the safety of a civil population, WELL DONE. ☆

THE KOLLIGIAN TROPHY

☆ U. S. GOVERNMENT PRINTING OFFICE: 1964—701/218/11



PRESENTED TO

CAPT. CHARLES W. BROZ

Captain Charles W. Broz of Wagner, S. D., was awarded the Koren Kolligian, Jr. Trophy for 1963 during ceremonies May 7 in the Office of General William F. McKee, USAF Vice Chief of Staff. The award is presented annually to the Air Force pilot who responded most successfully to an emergency in flight.

Captain Broz was selected from 22 nominees for his professional skill in coping with extreme difficulties while flying a TF-102 jet fighter at 30,000 feet over Labrador.

During an attempt to retract the armament bay doors, an explosion occurred, air rushed in around the cockpit, the aircraft began to vibrate violently, and the right front windshield tore loose.

Noise, vibration, windblast, and the extreme cold of 60 degrees below zero prevented communication between the pilots or with ground radar. After approximately 45 minutes and an unsuccessful attempt to penetrate the weather, Captain Broz closely followed another aircraft down through the heavy clouds, broke out at 500 feet above the ground, and made a successful landing. His action saved the life of his copilot, Captain Arthur P. Kearney, Seattle, Wash., who was numbed by the cold and windblast.

Captain Broz is the seventh recipient of the Kolligian Trophy, established by Mr. and Mrs. Koren Kolligian, Cambridge, Mass., in memory of their son, an Air Force jet pilot who was lost on a T-33 flight off the Farallon Islands, Calif., September 15, 1955. ☆

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

AUGUST 1964

Fifth Annual USAF

SAFETY CONGRESS

Maxwell AFB, Aug. 4, 5, 6th

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AEROSPACE SAFETY

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VOLUME TWENTY NUMBER EIGHT — USAF RECURRING PUBLICATION 62-1

Lieutenant General
Keith K. Compton

CHALLENGE OF THE SIXTIES

THE INSPECTOR GENERAL

LT GEN KEITH K. COMPTON, former Chief of Staff, SAC, has been assigned as The Inspector General, USAF. General Compton succeeds Lt Gen John D. Ryan.

A graduate of Westminster College, Fulton, Mo., class of 1937, he entered military service in February 1938. General Compton served initially with the 2d Bomb Wing, the first unit to be equipped with B-17 Flying Fortresses. In 1942 he joined the Eighth Air Force in England where he served as a squadron commander, and later as Group Operations Officer of the 93d Bomb Wing. He also commanded the 376th Bomb Group, which was awarded the Presidential Unit Citation for its operations in the Mediterranean in support of the British Eighth Army. General Compton was awarded the Distinguished Service Cross for flying the lead aircraft in the force of American heavy bombers that attacked the Ploesti oil refineries in 1943. He was credited with a total of 350 combat hours in flying 56 combat missions in the Middle East and European Theaters.

In July 1948, General Compton became Deputy for Operations, Air Proving Ground Command, directing test activities and flying all types of new aircraft accepted by the Air Force. He won the 1951 Bendix Trophy Race, at the same time setting a transcontinental speed record in an F-86.

Assigned to SAC in February 1953, General Compton successively commanded the 97th Bomb Wing, 813th, 823d, and 5th Air Divisions before being named SAC Deputy Director of Operations in July 1958. He became Director of Operations in September 1961, and was appointed SAC Chief of Staff in June of last year.

When we examine aircraft accident rates everyone in the Air Force can take just pride in the accomplishments of the past few years. There have been dramatic reductions in three areas of major concern — aircraft destroyed rate, major aircraft accident rate and the fatal accident rate.

Performance such as this is solid evidence that accident prevention efforts do pay off. History may well record the last decade as one of the most profitable eras ever from the standpoint of accident prevention. Commanders, supervisors, safety specialists and other concerned individuals, no matter what their job assignments, have teamed to establish a safety record that I believe will stand out in history as a glowing example of safety achievement. What this really means is that there are weapon systems and Air Force crewmembers available that otherwise would have been lost. Who among us would not be here today had the rates remained at the level of 1954? Which of our airplanes would be on the scrap heap if the rates had been allowed to stabilize at the mid-fifty's level?

Remember, too, that this safety performance was realized in an era of increased hazard potential. We had to cope with century series fighters, larger and faster jet bombers, a growing inventory of airborne missiles and rockets and demands for increasing combat and operational capabilities.

Methods by which reductions were achieved were to observe trends, spotlight problem areas, and concentrate on remedial measures. As problem areas were minimized or eliminated the rates cam down. Concurrently, of course, it became ever more difficult to ferret out potential accident cause factors.

Now, as safety specialists from Air Force units world-wide assemble at Maxwell AFB for the Safety Congress, the challenge is clear. Records disclose that, approaching the halfway mark of 1964, we are experiencing no decline in the major accident rate, the number of aircraft destroyed or total fatalities as compared to the same period in 1963.

Obviously we cannot rest on past achievements. In fact, the future will be more challenging than the past. Several reasons stand out: As the accident rate lowers it becomes more difficult to reduce it further; our equipment is becoming increasingly complex; we are using new, heretofore unknown materials; we are using old materials in fantastic new ways and our missions are imposing new and ever-increasing demands on our people and equipment.

Faced with these truths we must learn new, as well as improve on present, methods of preventing accidents. We must rally all available resources in this effort. Every USAF agency must be conscientiously involved in the struggle. Every possible tool at our disposal must be employed — nothing less will suffice.

The rewards for this effort can be great. An accident prevented may mean a life saved, or possibly, a hundred lives. We do not have inexhaustible resources, so what we have must be preserved. Safety specialists at every level can and must play an important role in rallying the forces needed to meet the challenge of the sixties.

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety.

Some maintain that there is a point below which the number of accidents cannot be reduced. The author maintains otherwise.

It has been said often and with complete accuracy, I am sure, that the primary cause of accidents is people. There are some who maintain that the reverse is equally true. In any event the other side of the coin must also exist—that people prevent accidents.

People were working hard last year in each of our commands so that accidents could be prevented. In 1963 USAF experienced 288 major flying accidents; the year before 380 occurred. Through our collective efforts then we prevented at least 86 accidents — 86 accidents did not happen that would have happened had the accident rate remained at the same level as in 1962.

Each of our major flying commands, including the Air National Guard, reduced its rate. MATS, for instance, halved theirs. At the end of 1963, the MATS rate had been reduced to .8 from 1.6 in 1962. The number of accidents was reduced from 11 to 8. The Strategic Air Command had 10 fewer accidents in 1963 than they did in 1962, and their rate lowered from 2.1 to 1.5. USAFE, primarily a fighter-equipped command, almost halved their rate also. They went from 14.8 to 7.6. Sixty-six accidents were experienced in USAFE in 1962, and only 35 in 1963.

All of our predominantly fighter-equipped commands are nearing a rate of 7, and even as recently as three years ago this would have been thought an improbability, if not an impossibility. MATS and SAC, however, are in a frequency area where they may well be approaching that nebulous, irreducible minimum that we have heard so much about. So now we come to the problem of how to reduce our rates even further.

Invariably, in the business of accident prevention, we are drawn to the accident which has just occurred for our most precipitous prevention activity. There is no doubt in any of our minds just after the accident that exposure did indeed exist. Our prevention efforts following the accident can be specific. They are propelled by accident motivation, and if our efforts and direction are accurate and allowed to run their full course, they will eliminate the specific exposure which caused the specific accident. Stated another way, under this concept we need an accident to prevent an accident.

We are probably approaching a point in time when we can no longer wait for an accident to prevent an accident, because the accident we wait for is the very one we must prevent if our rates and numbers are to be reduced even further.

Our past actions have been effective — very effective — but our future actions, while encompassing those which are time-proven, must become more sophisticated and be directed primarily toward removing exposure before the fact. The identification of exposure before the fact becomes a necessity if we are to become more effective in our prevention efforts. Can this be done? I am sure it can; in fact, I think it is already being done, to a degree at least, throughout all of our commands.

My interest lies primarily with the fighter-interceptor accident picture. The Air Defense Command, which also experienced a rate reduction in 1963, keeps track of their exposure in terms of precautionary landings. Every precautionary landing considered of any consequence at all by the unit safety officer is reported. In 1963, ADC flight safety officers reported 1208 precautionary landings. With this large sampling a good feel for exposure is possible.

For instance, F-101 pilots made 308 precautionary landings which did not qualify as incidents. Ninety-five of these occurred because of engine or associated engine system

THE IRREDUCIBLE MINIMUM

Lt Col Merle B. Nichols, Directorate of Aerospace Safety

ıalfunctions; an additional 52 sin-
le-engine landings were made
hich *did* qualify as incidents. Not
ıe accident involving ADC F-101s
ccurred last year as a result of an
ıgine or engine system malfunc-
on. It is obvious that exposure ex-
ts in the engine and associated sys-
ems as installed in the F-101, but
is equally obvious that, through
process of training and because
vo engines are installed in this air-
raft, the exposure has been neu-
alized very nicely.

However, the pilot of a single-
ıgine aircraft, faced with an en-
ne system failure, is in rather dif-
rent circumstances. F-102 pilots
ADC made 162 precautionary
ndings for engine system malfunc-
ons; in addition, 19 incidents oc-
ırred. Out of the 11 F-102 ac-
dents experienced in ADC last
ear, six were caused by engine and
ıgine system failures. Had two
ıgines been available, it is very
kely that no 102 accidents would
ıve occurred due to an engine sys-
m malfunction.

Returning to the 101B, 78 pre-
utionary landings were reported
a result of landing gear system
alfunctions; 14 incidents were also
sted due to these causes. How-
ver, six major 101 gear accidents
ccurred where the landing gear systems failed in some manner. With the 102, conversely, the gear was not a critical factor. Problems that were predominant in the gear system and caused some 70 precautionary landings primarily concerned the warning switches, microswitches, valve and linkage adjustments, rather than basic structural failures. Only one accident occurred involving the gear on the F-102, and it was the result of a local unapproved mod in the gear well, which resulted in one main gear failing to extend.

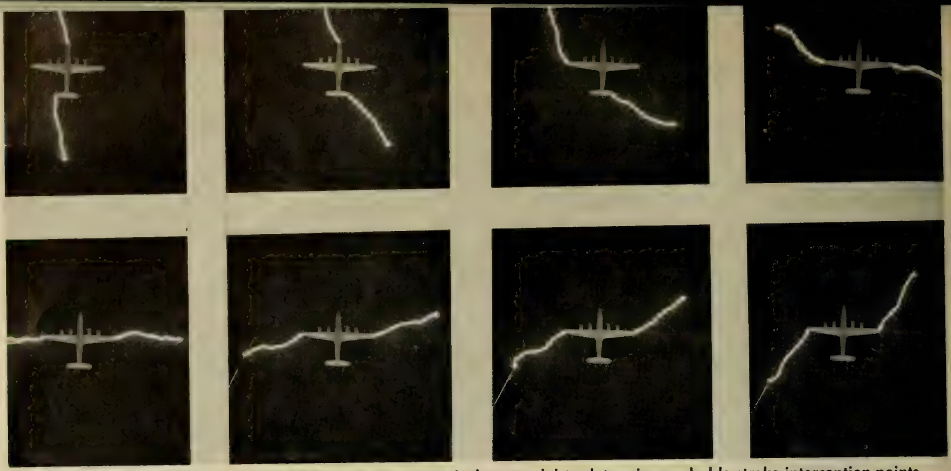
It becomes clear, then, upon examination of the ADC exposure that, when the frequency of precautionary landings and incidents of type is high, and if alternate systems are not available to neutralize the exposure, the accident rate will also always be high. It is clear that exposure can be identified before the fact in at least broad terms, and it is obvious that before rates can be reduced, that exposure must be reduced — exposure of a nature that cannot be neutralized by the pilot or backup systems.

Probably the most important factor influencing the single engine accident rate across the board concerns the reliability of the engine and its associated systems. Regardless of the type mission in which they are engaged, the single-engine aircraft will probably always have a higher accident rate than the multi-engine birds. The ADC accident experience reveals that almost 50 per cent of their single-engine interceptor accidents were caused by engine and engine system malfunctions. Out of 33 major accidents, 16 occurred for these reasons. I have examined the ADC exposure in some detail, but it is likely that in any fighter-equipped command the same conditions will exist generally. Probably only the degree will differ.

Before we can take a crack at reducing our fighter rates to an even lower level than they are now, we must make an identification of our specific engine accident exposure before the fact. Then, if our action is effective, there will be no so-called irreducible minimum, whether we are talking about fighters or those "flying towns." There is no question about it — we do have built-in basic exposure because of materiel, maintenance, and pilot reliability factors. But our birds are better and are becoming even more reliable all the time; our maintenance troops are doing a fine job, and our pilots are preventing many times more accidents than they are causing.

Still, if our fighter engines and engine systems are to become as reliable as we want them to be, total assaults must be made on engine systems reliability. With a malfunctioning engine, a fighter pilot will probably bring it home for you; with one that quits, he still may try, but the odds against his success are horrendous. The problem of before-the-fact accident exposure identification and neutralizing action lies for the most part with the support agencies of the Air Force. The on-the-line operators and maintainers are forced to play the hand out pretty much as dealt them. The improvement of system reliability may begin on the line, but the ultimate action is always the responsibility of support agencies at all levels.

In the next 12 months I challenge each of you to keep engine reliability as your goal. From the hand that holds the wrench to the hand that designs the change, concern yourselves with engine systems and engine systems reliability primarily, and if you do, I am naive enough to expect that we can cut our engine-induced fighter accidents by at least one full third in the next 12-month period. ☆



Photographs of one series of artificial-lightning tests on airplane model to determine probable stroke-interception points.

Lightning and Aircraft

Adapted from a longer work by the Editors of the Lockheed Field Service Digest and reprinted by permission of the Lockheed-California Company.

WHEN LIGHTNING STRIKES an airplane, a variety of effects can result, but in the vast majority of cases, damage will be slight. Injury to occupants is quite rare, fortunately, and we have seen no reports of an occupant of a metal airplane receiving a fatal shock.

If the aircraft were a perfect, uninterrupted, metal shell with no insulated conductors, such as antennas, leading into the vehicle, it is probable that a dangerous current would never be transmitted internally. Damage would be limited to pitting or occasional puncture of the shell. In many cases, occupants (including flight crews) are not aware that their aircraft has been struck unless a witness reports it, or damage is discovered after landing. Generally, skin damage will be limited to minor pitting or fusing of a few rivet heads, but small punctures do sometimes occur.

Evidence indicates that the path of the lightning in relation to the flight path is apt to determine how severe the damage is. A quick succession of strokes often follows along the trail of ionized air created by the first stroke. If the aricraft is flying along the ionization trail, a sustained flash (consisting possibly of a dozen or more strokes) may contact the skin at one spot and burn small hole, such as an arc-welder electrode will produce. Such a hole could be an inch or more in diameter, depending on the thickness of the metal. If the stroke path is perpendicular to the direction of flight, how ever, successive strokes will make contact progressively farther aft as the ionization trail "washes" aft in th slipstream; the resulting damage is then more wide spread, but of a lesser degree. It is also conceivable depending upon the attitude and flight path of the air craft in relation to the ionization trail, that an initia stroke to a wing tip for example could be followed b a succession of strokes moving inboard.

Scientists have recorded the wave pattern of man lightning strikes and have found a wide variation i current, duration, and other factors. Despite the wid variation, some authorities classify the lightning as ho or cold according to the type of damage inflicted. I general terms hot lightning involves lesser currents o longer duration and has inflammatory tendencies. O the other hand, cold lightning (high current and shor ıration) is more apt to inflict damage by the ex- losive heating of moisture or air in wood and in man- ıade materials of like composition.

These distinctions are mentioned here as a matter f academic interest only. Obviously, man has no con- ·ol over the nature of the stroke. We have to assume ıat aircraft will continue to be struck and do what we ın to lessen the possible damage or, assuming a certain mount of damage, ensure that flight safety is main- ıined at a high level.

One factor which determines the extent of lightning amage — the conducting quality of the exposed target -is controllable, but only insofar as other factors such s function and cost will allow. In modern aircraft ructures, cost is usually of secondary importance com- ared to function but, even so, it is obviously im- ractical to build the complete airplane of thick enough uminum or other metal that it would be quite immune lightning damage. The weight penalties involved ould make such a design impractical.

The usual approach to the problem is to determine r each type of aircraft the points of the airplane hich are most likely to be struck by lightning. Gen- ally speaking, these points are the extremities of ıe airplane but, as outlined above, the problem becomes omewhat more involved than this when considering an ircraft's motion through the atmosphere.

To gain some background of information about an rframe in relation to lightning, manufacturers may ıbmit metal scale models of new designs to a special- ed laboratory such as the Lightning and Transients esearch Institute (LTRI). In this laboratory, the ıodel is subjected to artificial lightning from various oints of a spherical perimeter. Once the probable oints of interception are known, more detailed studies e often made on actual aircraft components to de- elop the lightning protection best suited for specific oplications. Figure 1 shows just one such series of tests ı an aircraft model. In other series of tests on the ıme model, the airplane attitude was changed to cover s many variations as possible of aircraft position in elation to stroke path.

Unfortunately, as mentioned earlier, aircraft are not, ıd cannot be, perfect metal shells. The extremities— hich most often serve as electrodes for the strike— e commonly fitted with non-metallic radomes; an- nnas of various kinds project beyond the shield of the etal shell; and flight control surfaces and propellers ffer pointed projections which are vulnerable because their shape, their extreme location, and their bearing tachments to the shell. As might be expected, these e the components most often damaged by lightning rikes (see Figure 2).

RADOMES. Non-conductive shells such as radomes esent particularly thorny design problems, and in view the high incidence of lightning strikes which involve ıdomes, they warrant some particular attention. Their ısceptibility to lightning damage stems principally om their location and their non-conducting qualities. lthough they are primarily shields for the antennas, ıeir streamlining is also an important factor to the air- aft's flight characteristics, and if a forward radome damaged by lightning, debris carried aft by the slip- ream can do additional damage.

One apparent incongruity here is that *non-conductive*

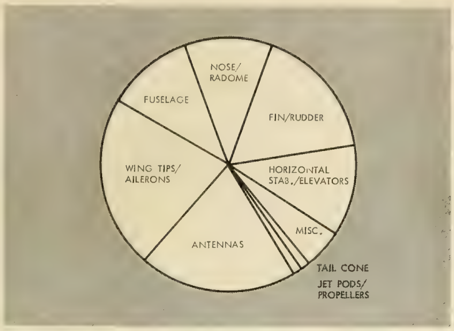


Fig. 2. Approximate distribution of points on aircraft struck by lightning. Estimated from various military and commercial strike reports.

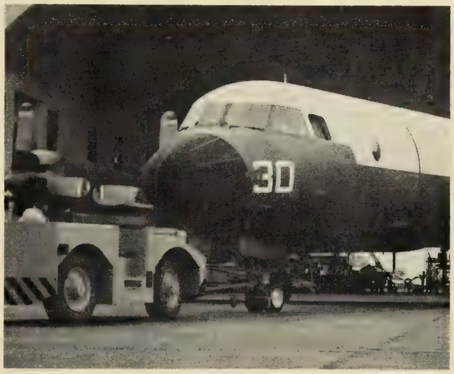


Fig. 3. Lightning protection of P-3A nose radome.

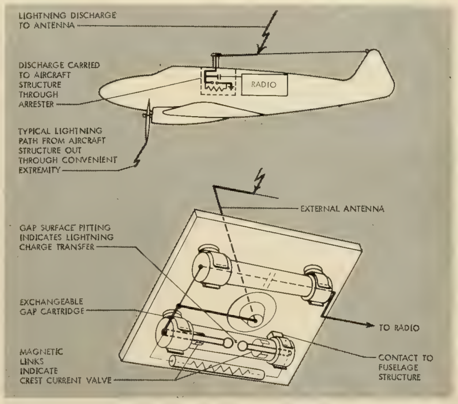


Fig. 4. Typical lightning arrester protection system for aircraft antennas.

radomes should be struck by lightning at all. The explanation is that the radar dish and metallic parts under the radome send out streamers, which are induced by an approaching stepped leader. Being a dielectric, the radome is heated intensely by the subsequent lightning stroke, and, although damage can be limited to pitting or small punctures, heating and consequent expansion of the composite material often causes fairly large holes to be exploded into the shell. In other instances, where radomes have been lost completely, it seems likely that explosive heating of the air beneath the radome was a factor. It should perhaps be mentioned that tiny punctures can also be produced by friction charge accumulations on the external radome surface, which puncture through to the interior. In any event, damage or possible loss of a radome is something that has to be considered in the design of an aircraft, mainly from the aerodynamic viewpoint.

It is generally not feasible to alter the location of a radome or its material to provide lightning protection, for the field of surveillance and/or the range of the radar would suffer. The only alternative is to divert the stroke to the skin by a chosen path via a conductor placed so as not to interfere unduly with the operation of the enclosed equipment. Diverters of two general types are in use, the consumable and the permanent.

For most applications, the consumable conductors are in the form of braided wire or narrow thin metallic strips, cemented longitudinally to the radome outer surface, and bonded to the metal skin. The length of the strips, their location, and their cross sectional dimensions are determined by tests to be optimum for the particular application. That is to say, they are planned to provide the best balance between lightning protection and loss of performance from the enclosed equipment.

The wires and the thin strips are not designed to survive a lightning strike, but they can divert a stepped leader to the skin, and even after they vaporize, strikes following in quick succession will find a residual ionized channel to the skin (see Figure 3).

Obviously, if the aircraft should intercept a second strike after the ionized channel has washed aft, a part of the radome protection system will be missing, but the protection zones of the strips are made to overlap, so that the radome is still well protected. In many cases, radomes will remain intact, and the only repair required will be the replacement of the braid or metal strip. The radome should be closely inspected, of course, for the local, intense heat may cause local delaminations of the inner or outer radome skin that are not readily seen. Also, tiny pinholes are sometimes created, and if water enters through such punctures it can interfere with radar operation.

An extensive protection system of the permanent type is the MAD boom of the P-3 anti-submarine aircraft. The rods, which extend almost full length on all four sides, are interconnected at intervals, providing a Faraday cage intended to spread the current so that the tendency of one rod to induce secondary currents in internal components is largely offset by an opposing tendency in the opposite rod.

ANTENNAS. These are often instrumental in leading lightning into the cabin where it damages transmitting-receiving equipment and exposes personnel to hazardous voltage. For this reason, lightning arresters (such as that shown in Figure 4) have been developed. These usually include a special spark gap between antenna and aircraft structure, a dc blocking condenser, and a static leak resistor all encased in metal/glass enclosures. They are located in the antenna lead-in adjacent to the aircraft skin. The arresters are expendable, that is, they must be expected to sustain some damage in diverting the heavy current, and should be frequently inspected to ensure that the correct spark-gap is maintained. Note that they are not intended to protect the external antenna, but are simply intended to provide a calibrated weak point in the antenna system which will break down and carry off the destructive peak voltage through a safe path rather than allowing the lightning to flash-over to structure inside the fuselage at a spot of its own choosing. Arresters are not provided for all antennas in all locations. Generally only those which are likely targets because of their shape and location are fitted with lightning arresters.

CONTROL SURFACES. Rudders and elevators, in particular, are prime lightning targets because of their location, and are susceptible to damage because they are necessarily hinged and constructed of light-gage material. There is no practical way to preclude *all* current transfer through hinge bearings, but it can be reduced to a certain extent by providing bonding jumpers between the fixed and the movable structure. This provides paths of low resistance in parallel with the hinges, so that a large proportion of the current is bridged safely. However, when millions of volts are applied — perhaps repeatedly — current will inevitably flow through the bearing. Consequently, the bearings should be inspected if a flight control surface is thought to have sustained a strike.

STRIKE EFFECTS AND SOME PRECAUTIONARY MEASURES. The intense field created by a lightning strike can, on occasion, be quite troublesome

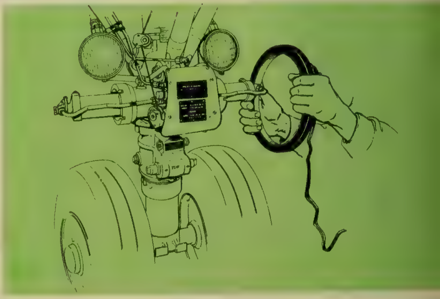


Fig. 5. Demagnetizing ferrous metal components wit portable de-gaussing coil.

to flight crews and maintenance crews alike. Ferrous metals may become magnetized, and indicators which utilize magnets may be disoriented by local steel parts. Magnetic compasses are most vulnerable in this respect, and after a strike has occurred, compass readings are suspect, and should be cross-checked by whatever means are available before trusting them for navigation. In this respect, the pilot can take the precautionary measure of ensuring his gyro-compass accuracy when static build up and/or region of strong potential gradients, often presaging a strike. Gyros are not so prone to malfunction if a strike occurs, and will provide an immediate — although only approximate — check of magnetic compass fidelity.

All ferrous metal components in magnetically critical areas should be ground checked after a lightning strike, for it is often necessary to de-magnetize them. Portable de-gaussing devices are available, some of which have proven capable of de-magnetizing even large components such as landing gear and their truss structures without removal from the aircraft (see Figure 5). Following the de-gaussing operation, all compasses should be re-calibrated by compass swinging.

Secondary currents are often induced by the near passage of a lightning bolt, and sometimes there are annoying side effects when induced currents flow in circuits where momentary potential produces actuation. Such incidents are comparatively rare, but cases have been reported in which all the passengers' emergency overhead oxygen masks have dropped out on a high altitude jet transport, bomber tip tanks have been jettisoned, and, by the rarest coincidence, on successive days armament pylons were jettisoned from two fighter aircraft of the same squadron. Most such side effects are spectacular and difficult to overlook when inspecting for strike damage, but it will be well for maintenance personnel to know their aircraft devices — such as electrically discharged fire extinguishers — and check them during the post-strike inspection.

Secondary currents sometimes work through audio circuits to produce a temporarily deafening crash in earphones. Here again, the crew can take heed of static build-up and unseat the earphones by way of self protection.

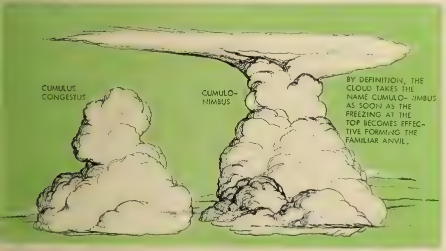

CUMULUS CONGESTUS
CUMULO-NIMBUS
BY DEFINITION, THE CLOUD TAKES THE NAME CUMULO-NIMBUS AS SOON AS THE FREEZING AT THE TOP BECOMES EFFECTIVE FORMING THE FAMILIAR ANVIL.

Fig. 6. Cumuliform clouds responsible for lightning strokes. Throughout the article we intend the term "thunder cloud" or "cumulo-nimbus" to apply also to the cumulus congestus — the most advanced stage of cumuliform cloud before its final evolution as a cumulo-nimbus.

There have been many instances of crews becoming temporarily blinded by lightning strikes while flying at night, and such blindness has often persisted for several minutes. One precaution which might be taken at the flight crew's discretion is to turn up the cockpit lights to full bright and keep the eyes focused on the instruments when static, St. Elmo's fire, or other warning signs indicate the likelihood of a lightning strike. This action will have the effect of contracting the pupils of the eyes, making them less susceptible to damage from a subsequent lightning flash. Of course it would never be advisable for the entire flight crew to restrict their vision in this way, but if one member does so, the small loss in observation will be well repaid by the degree of protection gained against an entire flight crew being temporarily disoriented.

AVOIDING LIGHTNING. The golden rule in avoiding lightning is to not fly in, or in the vicinity of, thunderstorms or any of the clouds with high vertical development. These are often called collectively clouds of the cumulo-nimbus type but a meteorologist would also include in the list of various clouds to be avoided others, such as the cumulus congestus, which are simply advanced stages in the development of a cumulus aspiring towards a cumulo-nimbus (see Figure 6). Of course, as far as this golden rule is concerned, the problem of possibly being struck by lightning is not so serious as the problems of encountering turbulence, icing, and/or hail — all of which are particularly associated with the thundercloud. However, if we assume that we are forced to fly in the vicinity of a thunderstorm for some reason or another, then it might be helpful to discover some more rules.

Statistics on lightning strikes to aircraft seem to show that altitude plays a minor role, in a practical sense, as far as determining the likelihood of being struck. Reports show that most strikes to aircraft occur below 20,000 feet with a certain emphasis on the 5 to 10,000-foot level but these figures also appear to reflect the altitudes where most flying occurs — even jet aircraft spend a large proportion of their average flight time climbing or descending at low operational levels. About the only conclusion that can be made is that strike probability drops sharply above 20,000 feet. Incidentally, this statment is further supported by Air Force statistics which show that 9 of 11 strikes reported on B-52's were below 20,000 feet, but is somewhat repudiated by another record of 14 jet aircraft strikes which shows a wider spread of altitudes corresponding more closely with the greater range of operating altitudes of the pure jet. However, strike probability almost certainly coincides with the altitude range of the cumulo-nimbus which, in general terms and depending upon world location, is commonly found between 3 and 30,000 feet, is somewhat less frequent up to 50,000 feet, but can even extend to higher levels than this.

Perhaps a more satisfactory method of avoiding strikes near thunderstorms is to keep a watchful eye on the ambient temperature. The majority of lightning strikes (about 8 per cent) occur in the temperature range — 10°C to +10°C. Thus it appears that a good precaution to flight crews would be to select a flight level where the temperature is not near freezing, although it should be noted that — 70°C to +10°C corresponds to a considerable range of altitude (2500 feet to 12,500 feet). It should also be noted that temperatures inside and outside of clouds can vary a great deal. Incidentally, the fact that most strikes occur near 0°C correlates quite well with thunderstorm electrification theories that charge separation occurs at about the freezing level. However, it is to be expected that positive charge centers at the tops of tall clouds are at much lower temperatures than this.

RELATED ITEMS AND QUERIES

STATIC DISCHARGERS. These are commonly fixed to the trailing edge of aerodynamic surfaces, especially flight control surfaces, to aid in the dispersion of friction charges which accumulate on the skin of the aircraft. There are a number of designs, the most common type being a carbon impregnated wick, frayed at the trailing end to provide intimate contact with the slipsteam. After a lightning strike, they should be inspected and replaced as necessary. Except for this reference, any further discussion regarding these devices should hardly be justifiable in an article about lightning. However, one purpose of this article is to dispel popular myth. The purpose of a static discharger is just what the name implies — to discharge static. A widespread misconception that they serve a dual purpose and also, in some way, discourage lightning strikes stems from the equally popular misconception that an aircraft can become sufficiently charged during flight to originate its own lightning discharge.

Many reputedly authoritative articles on the subject draw definite distinctions between bolts of *natural lightning* and bolts due to *static discharge.* It should be emphasized that aircraft skin friction can at most generate moderately high voltages of about 100,000 volts with charging currents of 0.0005 amperes. These values hardly bear comparison with those of a "natural" lightning discharge, which involves potentials of 10 to 100 million volts and currents sometimes exceeding 100,000 amperes.

However, as indicated earlier, static dischargers do enter the lightning picture to a certain extent. Under certain conditions, they can provide a local diverting action to a lightning bolt for a distance approximately equal to the length of the dischargers. It follows that static dischargers should not be installed on an airplane without due regard to this diversion factor. One placed on the outboard end of an aileron for example could well direct a lightning stroke to itself away from the wing tip, and to quote Newman and Robb, ". . . strikes (which are diverted) to most of the short dischargers in current use jump off the discharger over to the adjacent metal skin resulting in a costly and time-consuming aircraft repair problem, i.e., the repair of skin damage." (From a report by Messrs. M. M. Newman and J. D. Robb, Lightning and Transients Research Institute.) While on this subject, Newman and Robb also believe that the present dischargers could be mounted with bases which would greatly reduce the damage either adjacent to or at the base of the discharger.

We might at this point answer a question that is relevant and is often asked. High speed fighters frequently do not have and do not require static dischargers. The jet engine exhausts are usually sufficiently ionized to carry off most of the accumulated charges of precipation static. However, this is not true of all jets and, as a general rule, static dischargers are necessary as jet aircraft size and performance increase.

Incidentally, Lightning and Transients Research Institute has developed a graded resistance lightning diverter rod which combines the function of a static discharger with that of a lightning rod. The use of such a device controls, to some extent, the specific localized point at which lightning might strike (Figure 7). The diverter rod base is designed to carry the stroke currents without damage to the skin or air frame at the attachment point.

RADAR AS AN ATTRACTOR OF STRIKES. The incidence of lightning strikes to radar devices is inevitably high for reasons which have already been discussed. It is also well known that the energy transmitted via some radar beams is of a high enough order that it can (in some combinations of wave-length, range and power) burn a living organism internally, illuminate incandescent lights, or perform similar feats. Not unnaturally, this has caused some speculation as to whether it is possible for radar to produce ionization of the atmosphere, and thus attract lightning discharges

Lightning and Transients Research Institute conducted a study on this particular problem of lightning diversion. Selecting an altitude of 40,000 feet as a basis of evaluation (generally speaking, the problem increases with altitude), they arrived at the conclusion that the possibility *might* exist at that altitude if th power flux of the most intense radar beams existing today were increased by a factor of 10.

We recently requested Mr. Robb of LTRI to comment further on this interesting subject. Taken slightl out of context, the reply was: ". . . we do not believ for average radars in present use this is much of a factor as the maximum electric field magnitudes are rathe low, well below the ionization levels for medium fligh altitudes where most lightning strikes occur. Howeve it is granted that for very high power radars, high H antenna voltages, and high altitudes, ionization coul be a significant factor in attracting strikes." ☆

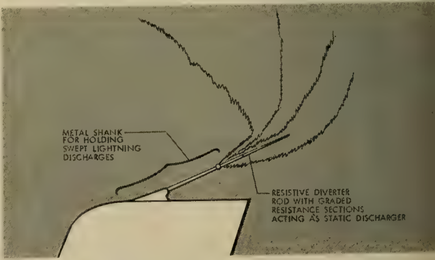
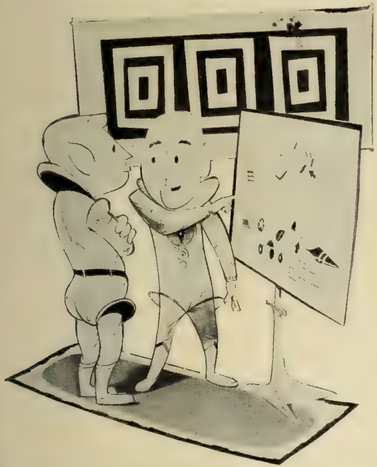

METAL SHANK FOR HOLDING SWEPT LIGHTNING DISCHARGES
RESISTIVE DIVERTER ROD WITH GRADED RESISTANCE SECTIONS ACTING AS STATIC DISCHARGER

Fig. 7. Combined static-discharger/lightning-diverter rod f empennage or wing tip installation.

TWANG

A Science Fiction Saga that may border on truth . . .



At the duly convened meeting of the CIA committee of the MIPA (Martian Interplanetary Progress Association), the problem for resolution was personnel emergency exit systems as employed by inhabitants of other planets. To be more specific, the best intelligence brains, with the help of engineering specialists of course, were dedicated to resolution of why earth men favored such highly intricate systems for emergency ejection of aircrews. The chairman rapped the table with his gavel.

"Gentlemen, F-3 has just returned from an observation mission to planet earth and has charts and diagrams outlining the systems in use there. He will show these, then we will attempt to rationalize why such systems are used and make a determination as to whether we should recommend any such similar devices for our use." A few of the Martians snickered and shook their heads, causing the chairman to hastily add, "Gentlemen, we must be fair. Surely, though I admit not one of our colleagues has been able to determine why, there *must* be a reason why the earth people always go to complicated systems. Okay, George, go ahead with your briefing."

George did. He unfurled charts and diagrams, all drawn in multicolors, and explained briefly the operation of the systems and their history. It was obvious that complexity was an indication of progress as, in earlier days the chutist merely flipped his machine inverted and undid his belt, or stepped over the side. In the most modern systems George pointed out that the trend was toward:

- An intricate network of safety pins and lanyards that could only be properly positioned with the aid of a printed list of sequential instructions.
- Ballistic devices that performed such functions as shearing pins, tightening leg lanyards, compressing elbows, deploying chutes, even swatting the occupant's posterior, all in a critical time sequence.
- A system of rails, tubes, gas chambers, ballistic channeling devices and recoil absorbers.

Then, to illustrate that the trend showed no indications of abatement he furtively unfolded a chart he had filched. This one, with TOP SECRET stamped all over it in red, provided details of a system wherein explosive bolts were used to separate the personnel area as a unit. It incorporated some of the latest designs of the older systems and had an intricate system of fins, chute deployment devices, and other stabilization paraphernalia.

When George had finished, there was considerable head shaking and moaning. One of the members complained that he was feeling ill, but the chairman refused to excuse him. Another took out a rubber band, stretched it and let go. It shot across the room. The chairman frowned. The guy who had shot the rubber band shrugged. "No offense intended, sir. That device came from down there. It's simple and reliable . . . works every time. I was just wondering why they don't use rubber bands?"

"George," the chairman signified the Martian standing by the charts.

"My deduction is," and he unrolled another sheet of paper with a bar graph on it as he spoke, "they have apparently reached an acceptable success rate. It's not as good as they had when they flew biplanes, but it has held almost constant for the past several years. Obviously, the stability of the success rate has bearing on designs they accept."

"Is it a good one?" another member asked, obviously in disbelief.

"Well," George hedged, "my personal opinion is no—only about 80 per cent survive, but . . ."

At this point the one who had shot the rubber band interrupted. "It's time for lunch," he said. "I recommend that we close out this project with the endorsement of our system and let the earth inhabitants go about their expensive, unreliable way. A lot of them must keep occupied, designing, installing, learning to use and maintain their system. If they went to ours it would throw a lot of people out of work. That might pose a bigger problem. There may be economic-political factors we haven't considered." As he said this he rose, pressing down firmly with a pudgy right thumb and forefinger on an object he had placed on the desk. "But for the sake of the poor misguided ones who have to ride around with such a system we might leave a sample of a device we have found works 100 per cent of the time, is simple to construct and install, and needs no maintenance. George, next trip down, why don't you just leave one of these on the seat of one of their airplanes?" At that moment he parted thumb and forefinger and a small spring shot up, striking the ceiling hard enough to leave a dent.

The committee members nodded in agreement and as they left for lunch, the room still rang with the last echoes of the sound made by the spring, "T. . w . . w. . a. . a. . n. . n. . g ! ! ! ☆

DISORIENTATIO

Maj William R. Detrick, Aviation Physiologist, Medical Group, DTIG

The weather en route for eight F-100s on an overseas deployment was essentially as forecast with broken cirrus layers overhead and a broken to overcast underdeck. The flight leader, Waxy 41, established radio contact with the KC-135 tankers approximately 80 nautical miles prior to reaching the first air refueling check point. The flight was informed that the tankers were maintaining 29,000 feet and were ready to rendezvous.

The weather at this time was reported by members of the flight as VFR with 30 to 40 miles inflight visibility. The stars were plainly visible overhead and there was a thin overcast several thousand feet below flight level. The glow of larger cities could be seen through the cloud deck and occasional breaks in the clouds revealed surface lights.

As the flight approached the tankers, a call was made by Waxy 41 to position the tankers on the refueling heading. The flight established visual contact and the tankers began a left turn to an on course heading. The flight was then approximately four to five miles behind the tankers slightly low and closing slowly. Airspeed was increased from 300 to approximately 330 knots and Waxy 41 instructed his flight of four to "go loose right echelon" to a prebriefed refueling position. At this time Waxy 43 and 44 were in fingertip position on the left wing
Waxy 41. The second section of t
flight, Waxy 45-48, was aft and
the right of the first flight. Th
were to rendezvous with the seco
tanker.

Waxy 43 didn't immediately re
to the echelon right instructio
Then he started a slight right ba
to cross over, held about 20 degr
of bank for approximately five s
onds then rolled out straight a
level. A few seconds later he ente
a 20 degree left bank, held this
about five seconds, and again rol
straight and level. He then mom
tarily tipped his right wing a
leveled out.

Waxy 44, the wingman, assumed he was to cross over to the right wing and started to drop back for the cross over. At this time, Waxy 43 stated, "Watch me, I've got vertigo." He then rolled to a level 90-degree left bank. Waxy 44 immediately transmitted, "You are in a 90-degree left bank, turn." Waxy 43 then rolled an additional 90 degrees to the left and disappeared below 44 who was three to four ship lengths behind and slightly to the left. Waxy 44 had to pull up to avoid hitting 43 and transmitted, "You are in a Split-S." He did not see 43 again.

The IP flying in the back seat of Waxy 41, an F-100F, heard this "Split-S" transmission and immediately transmitted, "Roll out and get on instruments!" He then asked 43 what his altitude was. At this time, other members of the flight stated that they heard Waxy 43 ask "44, where are you? I want to get on your wing." There was some confusion as to whether one or more transmissions were made by Waxy 43 of various altitudes but several members of the flight heard him state, "I am at 7000 feet." The lead ship IP immediately transmitted, "Bail out, bail out," and Waxy 43 replied, "I'm getting out."

The total time from Waxy 43's transmission of "Watch me, I've got vertigo" to his reply, "I'm getting out" was approximately ten seconds. The flight had been air borne one hour and 18 minutes. Waxy 42 flying on the right wing of the lead aircraft saw 43 enter the undercast and heard his transmission that he was at 7000 feet and ejecting. A few seconds after this transmission, the clouds lit up. He further stated the noise level behind Waxy 43's transmission made him believe that the canopy was off at the 7000-foot call.

The pilot's body was discovered still in the harness of an apparently normally deployed parachute. Although the ejection seat was never found, it is assumed it worked properly in all sequences. The parachute was found by the search party to be fully deployed without any torn panels. The medical officer attributed the pilot's death to injuries sustained during ejection at over 550 knots. Evidence indicated extreme flailing due to windblast. Although high speed ejection is rare — about one per cent above 500 knots — and lethal flailing is an extremely rare phenomenon, the potential hazard is recognized. The need for simple and efficient restraints for the extremities is quite real, provided they do not compromise reliability for low level ejections. Cause of the accident was attributable to failure to recover from an unusual position after spatial disorientation.

A possible contributing cause was suspected failure of the attitude gyro system giving the pilot improper attitude indications.

Although this pilot's transmissions aided in determining the cause of this tragic, fatal accident, not all such accidents are as easily solved. Many, however, continue to be blamed on spatial disorientation or "pilot's vertigo." Much has been said on these pages and others on the subject. But the fact remains that we continue to experience accidents from this cause. So, let's air the subject again.

Spatial disorientation can range all the way from simple confusion as to exactly which way that aluminum arrow is aimed, to complete vertigo with the accompanying spinning sensations, twitching of the eyes and perhaps even losing the "cookies." The physiological mechanism can be explained by your flight surgeon or physiological training officer but for now let's concentrate on *when* it happens and how to *prevent* it. You see, the idea is to keep from becoming *disoriented* in the first place and, should it occur, to *reorient* in the least possible time.

Remember that man must have a *visual* reference to maintain orientation in flight. He must have visual contact with the ground, his instruments or another aircraft in flight. Any other sensations such as the "vestibular apparatus" or "muscle sense" must be ignored.

Second, our accident reports show that the problem is usually one of change-over from one set of horizons to the other: changing from ground contact to instruments, or from formation to the gages.

In the fatal accident related above the pilot was no greenhorn. He had over 1700 hours flying time of which 1300 plus were in this model aircraft. He had recent experience in night and weather flight and had completed a proficiency flight check less than a month previously. His last instrument course seven months back had included the command's vertigo training course. So, what happened? Part of the answer is that even experienced pilots can experience disorientation — it becomes less likely with more experience—but it *can* happen.

In the accident at hand the pilot reported that he was experiencing vertigo. This is entirely possible since he was in night formation with many misleading lights — his flight leader's, the stars, the tankers' and, periodically, the ground. Since he was attempting a cross-over from behind and below, his head was tilted back slightly. Next he accomplished two turns. These conditions can cause some disorientation of either minor or major degree.

At this point, it is entirely possible that a cross reference to his instruments gave him *mis*-information. (The attitude gyro had a history of erratic behavior and had to be coaxed to erect properly on engine start prior to takeoff.) Disorientation plus *mis*-orientation soon put him in an attitude and at an airspeed where ejection was the only choice and proved fatal due to high speed. At this point, each of us might review ***his*** procedure for proper recovery from unusual positions. Power adjustment is always high on the priority list.

What's the answer? How can we prevent more accidents of this type? Only by an overall attack on the problem. First, training in the problems of disorientation must continue. Second, the instrument people *must* provide reliable instruments! Our recent history of attitude indicator failures is too high. *Any* failure of this vital instrument is unacceptable. In the meantime, good instrument practice will give us a cross-check to the *other* instruments in the cockpit. Use the airspeed, altimeter and stand-by gyro. An antiquated instrument such as the needle/ball (turn and bank) is of limited, if any, value in century series aircraft. The best life insurance is still practice.

Is it *mis*orientation or *dis*orientation? Mox nix! The result can be the same. And it can happen in a hurry — no time to plan or make mistakes. Action must be preplanned and practiced. Get on the gages — but use them all. ☆

HISTORY REPEATS REPEATS

LAST YEAR AN ARTICLE titled "Kilo Confusion" appeared in this magazine. It told how a flight of Air Force aircraft was recovered during submarginal weather. They made it in an environment that included such disaster primed situations as one-eighth mile visibility on the landing runway, identity confusion, low fuel states, two other aircraft with emergencies, improper call signs, unnecessary radio transmissions, a less-than-100-feet near-collision and unreliable radar due to heavy precip.

Call it fate, chance, luck — it all adds up to a miracle — they all made it.

Two years ago an article titled "Non Support of the Pilot" appeared in this magazine. This article dealt with one of a flight of aircraft trying to get in under somewhat similar conditions. Weather was indefinite, 500 obscured, visibility one mile in a heavy thunderstorm, the AC system went out, radar contact was frequently lost because of precipitation, the aircraft was descended below minimum altitudes and unauthorized transmissions added to the confusion. Somehow the pilot managed to fly in and around this storm until out of fuel (38 minutes) before he ejected. This appears to be quite a feat when it is realized that he had no operating fuel boost pumps, air-speed-mach indicator, altitude-vertical velocity indicator, pitch and yaw dampers and windshield de-fog or anti-ice.

And now it's 1961. Late one day this spring a flight of aircraft was being recovered through thunderstorm packed skies. Here are excerpts from some of the pilots' statements:

"I called for a missed approach and asked to be lined up again on the ILS but got the same results as the first approach. I made several large corrections and got back on center line just as I broke out, about two miles out. The turbulence was moderate and winds aloft very gusty, causing airspeed control to be difficult, so I held an additional 20 knots to give me adeqate control for all this maneuvering on final."

"Turning on final I intercepted the ILS course and set up for final. Upon reaching the glide slope, my best flare was 184 and an approach speed of 194. I tried to maintain this but due to the wide variations I increased it to 210. At one time on approach it got as low as 170 before I could stop it with mil power. Completed approach and broke out at approximately one-half mile from the approach lights, 100 to 150 feet right of center line. My ILS indicated I was on course and on glide slope at this time. I could only see the approach lights and the approach end of the runway. I completed the landing from there. After clearing the runway I gave weather report to ground control. I judged it to be about 100 feet and one-half mile. I landed out of this approach due to the fuel condition I had at that time. I considered it safer to land than to pull back up into the weather since the weather was getting worse and with numerous thunderstorms all over the area."

"At approximately 20 miles out we turned left to 360 degrees going between two thunderstorms. On the final approach we broke out of the weather going past .... with turbulence increasing. The airspeed fluctuated 20 knots either side of desired. We flew the final at an average best flare speed plus 20 knots. At approximately two miles out we encountered low scud clouds and also rain which blanked out the runway. We leveled off at minimums and at one mile the runway still was obscured by rain so we made a missed approach. On downwind we encountered extreme turbulence. This was reported to GCA. The airspeed fluctuated between 230 to 270 with no change in power setting."

"At approximately 400 to 500 feet above the terrain an extreme wind sheer was encountered and our airspeed dropped from 210 knots to 165 knots (26 knots below best flare speed) in a matter of a few seconds. Throttle was immediately applied to mil power and the attitude was held until airspeed was regained and approach continued. It was difficult to ascertain where we broke out of the overcast, however, I estimate it to have been 200 feet. The severe turbulence ceased immediately upon break out and normal approach and landing were accomplished."

"I ran into lightning and severe turbulence north and west of the field. Arriving at minimums I first saw the strobe lights about 300 feet to my left and took it around. The weather was not 900 feet, but more like 300 feet. The second approach was about the same except I was to the left of the runway and it was too late again to line up on the runway lights which were somewhat

hazy. On the third ILS final Approach Control advised me their monitor light for ILS came on and to carefully check my instruments. About this time the off flag (I believe glide path) appeared and I leveled off at 1100 feet. As I passed over the field I only saw a haze of the ramp flood lights. I called for the .... weather and diverted with no further problems."

"I centered the CDI and picked up the glide slope. I broke out over the approach lights at about 500 feet. I hit extreme turbulence or a very great shear and the aircraft settled out. I applied military power but the aircraft touched down and I got it into the air. Immediately thereafter we struck the power lines."

The aircraft that hit the ground, took out the power lines and a fence, lost one engine and had only partial power on another, then diverted due to weather and aircraft damage, was the eighth aircraft. Here is what happened to the seven ahead of him.

The first two made it on the first pass.

Nr 3 landed on his second approach.

Nr 4 landed on his third approach.

Nr 5 landed on his second approach.

Nr 6 landed on his first approach.

Nr 7 made three missed approaches, then diverted.

Eight years ago an Air Force aircraft took off into a thunderstorm, hit a downdraft, crashed, and 46 were killed.

A few weeks ago an Air Force aircraft, making an approach during a thunderstorm, crashed with a higher fatality toll.

The same weekend another Air Force aircraft, flying through an area of severe thunderstorms, crashed and all on board were lost. A wreckage pattern over an area of approximately five miles indicates inflight structural breakup.

Following are briefs, selected from some of the incidents and accidents during the past two years, to illustrate the force of thunderstorms on various Air Force aircraft:

A T-33 nose gear failed on landing when the pilot lost sight of the runway just prior to touchdown due to a heavy shower. Weather: 3500 overcast, one mile in heavy thunderstorm. Wind southwest four knots, gusting to 33. Thunderstorm moving east.

F-102 damaged by barrier engagement after landing during a thunderstorm. During penetration weather deteriorated to 500 obscuration, three-fourths mile, thunderstorm, wind light and variable. Pilot had poor braking action and drag chute failed to blossom in heavy rain.

F-102 flight of two flamed out due to compressor stalls when a thunderstorm was penetrated at 45,000 feet. The flight had passed between two thunderstorms, but couldn't outclimb or outturn the one behind.

A C-131 (on ground) fuselage buckled in high winds. Ceiling and visibility were zero in a heavy thunderstorm, possible tornado.

Six C-123s were damaged on the ground by a thunderstorm.

An F-100 crashed during an attempted go-around during a thunderstorm. The flight had been recalled due to the approaching storm, but the landing attempt was made as the storm passed over the field. Fuel was sufficient to reach the alternate or for one hour holding.

A B-52 received hail damage at 35,000 feet in clear air with a rapidly building thunderstorm 10 miles away.

A B-52 was damaged by hail at 28,000 feet. Thunderstorms were being avoided and the hail came from a storm that appeared on radar to be below the aircraft.

A C-47 was lifted from chocks and blown 150 yards into a building. Visibility was zero in the thunderstorm with hail and peak gusts 56 knots but estimated to be 80 knots in the area due to venturi effect between buildings.

A C-123 encountered severe turbulence near a thunderstorm. One passenger was injured. The pilot considered a distance of 10 miles far enough to avoid turbulence.

A B-57 made an emergency landing after a lightning strike. Landing was made in a thunderstorm and the pilot retracted the gear to avoid overshooting because of poor braking action.

ED. NOTE: Help! We've been writing articles like this for years. In peacetime, can't Air Force pilots reduce exposure to weather associated incidents and accidents by holding, going to alternates, delaying takeoff, and flight planning around thunderstorm areas? Will someone help? Does history have to repeat? ☆

He who sits and waits may wait forever. Learn how to . . .

Help RESCUE Help You

John L. Vandegrift, Hq Air Rescue Service, Orlando AFB, Fla.

Rescue best helps those who help themselves. To approach the problem of staying alive following an emergency bailout, ejection, or crash landing, the professional pilot or aircrew member can do much to guarantee his eventual rescue if he knows and puts into practice well proven survival techniques and procedures.

Air Rescue Service has learned over the years that the odds are against luck alone in a survival situation—overwhelmingly so. Percentagewise, the man who chooses to leave everything to luck is a very bad insurance risk. The better you are prepared to meet an unexpected emergency, the better are your chances for collecting retirement pay.

The Air Rescue Service is in existence to help you reach this happy goal. The primary mission of ARS is to save the lives of USAF flyers in distress. Often people lose sight of this fact because of the large number of non-military mercy missions in which Rescue has been involved and about which there has been so much publicity. Floods, earthquakes, and avalanches attract world-wide headlines; the sick child saved and the lost hunter found make big local news. We also get a lot of publicity on our aerospace recovery work but never forget, the Air Force crewman is the real reason ARS is in business.

Brigadier General Adriel N. Williams, Commander, Air Rescue Service, states: "Our motto has always been 'That Others May Live.' But we should add 'that they may fight again.' We are primarily a part of a military machine, and our humanitarianism is the wonderful and satisfying by-product — but it is only a by-product. Our principal job is to retrieve irreplaceable flight crews."

An earlier article discussed how and why an aircrew in trouble or in potential trouble should alert rescue facilities, specifically, what should be done and how it should be done. Now, let's discuss what survivors should do to aid the search and rescue effort and provide some useful tips on how to help the searchers find you.

Today's high-speed aircraft slice swiftly across the lines of latitude and longitude. When cockpit temperatures are controllable, it is easy to forget that the temperatures on the earth's surface can vary greatly from hour to hour. Be prepared for the worst. Dress to survive under the worst conditions you can possibly encounter on any particular flight.

In one incident, the fact that the man was alive to be rescued was, of itself, a minor miracle. Luck and guts made the miracle possible. He had been on a flight to test a fabric-lined, rubberized Alclad exposure suit and had been so uncomfortably hot that the other crewmen had tried to talk him into taking it off before he melted away. His decision to complete the test saved his life. He had protection against the cold when he was forced to eject from the aircraft, following an explosion, over bleak northern Manitoba, Canada.

When he hit the ground he had no survival gear other than his service .38, two matches, a bailout oxygen bottle, his parachute and six sulfa pills his wife had made him carry along to help ward off recurring pneumonia attacks. With these few items, plus courage and an unconquerable will to live, he survived where lesser men would have perished. He never quit trying.

Knowing he was partially hidden, he did his best to get a better spot but couldn't. The snow was soft and deep and the man was severely injured. He fired his pistol, hoping to be heard or seen. On the second night he ignited his oxygen bottle when he heard one of the search aircraft nearby. It made a good flare but he wasn't spotted. Despite pain and the drain on his dwindling strength, he gathered his chute around him for warmth when there were no planes around and spread it out for a signal whenever he heard the sound of engines.

He tried for food and managed to shoot a rabbit. Although it lay but 20 feet from him, he was unable to get to it because of the deep, soft snow and excruciating pain from a leg mangled by the explosion. After his rescue, the doctors were amazed at his remarkably good condition and credited the sulfa pills he had sucked on during his 79-hour ordeal with minimizing infection in his leg. In a situation most men would have considered hopeless, he never gave up hope, he never quit trying. He kept his head and he was alive when a Rescue chopper, airlifted into the area, lowered a pararescueman and hoisted him to safety.

Some men possess a working knowledge of the art of survival and practice it, others assume an "it can never happen to me" philosophy.

We will not concern ourselves with this latter group. Repeatedly, experience has demonstrated that they are poor insurance risks and in all probability will not be alive when Rescue makes the scene. But for the others, it might be well to point out that the relationship between good, clear signals and quick salvation is frequently more than coincidental.

Following bailout from multi-place aircraft every efort should be made to regroup in the vicinity of the ircraft when possible and then build the biggest most pectacular signal you can dream up under the circum-tances. If no "store bought" signals are available, pre-are signal fires, spread chutes — always remembering o break up the terrain and achieve as much contrast s possible.

Be ingenious, as the above survivor was when he ried to use his bailout bottle to improvise a flare. In the rctic, for example, you may feel that you need a sea arker and Mae Wests or LPU's like you need more now, but the fluorescence of the marker and the black moke of a burning life jacket make excellent signals gainst the glaring white background.

Don't abandon your survival equipment—ever. There ave been cases where survivors have departed the cene of an accident leaving many valuable aids behind. ost of them are dead. Protect whatever supplies ou have; you may find a valuable use for them later.

The importance of regrouping when confronted with survival situation cannot be overemphasized. Morale improved and the group's collective skills and talents n be utilized to the utmost. United you can sur-ive; divided you may fail.

During night searches for downed aircraft and sur-ivors, Rescue aircraft will be on the lookout for any gn of light — flares, fires, flashlights. These can be een for many miles. During the daylight hours, smoke gnals and signaling mirrors are very effective.

As far as the more complicated survival gadgets are oncerned, there can be no doubt that one of the most aluable aids in assisting Rescue to locate you can be e survival radio. When they work, and the new ones e getting more reliable all the time, they can make ontact with Rescue aircraft on line of sight even when e survivors are hidden from view in wooded or broken rrain.

The old URC-4 operates on 121.5 mc or 243.0 mc d can be received up to 20 nautical miles on ADF or NM on tone from search aircraft flying at 10,000 et. The URC-10 is coming into the inventory, along ith the personal locator beacon, URT-21.

Currently the standard item, the URC-11 operates 243.0 mc and can be received up to 35 NM on ADF 70 NM on tone from 10,000.

Even more sophisticated and powerful, the URC-10 operates on 243.0 mc and can be received up to 50 NM on ADF and 80 NM on tone or voice from Angeles Ten.

Something that has been needed for years is the Personal Locator Beacon. These electronic handy dandies transmit only a homing signal on 243.0 mc. Generously issued on the basis of one per aircraft position, one for multi-place life raft, one per alert crewmember when authorized for use by the using command, and one for parachute, this gadget should make homing in on a downed aircrew a comparative snap.

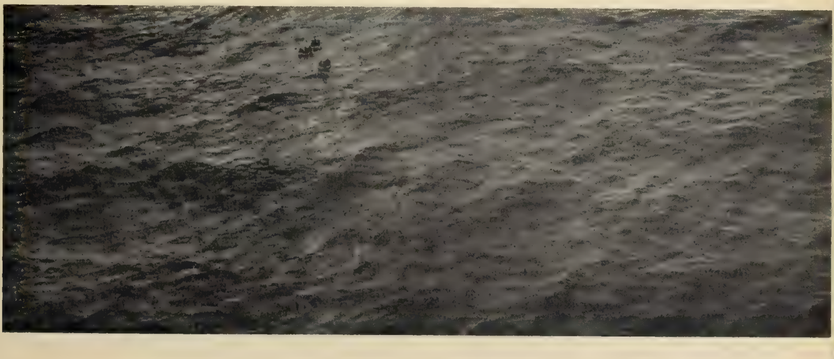
This radio operates automatically with deployment of the parachute during bailout and also can be operated manually after landing. Quite compact, the unit measures one and a half inches by three and a half inches by six inches and weighs but one pound.

The reception ranges of all these beacons can be increased by as much as 50 per cent by installing preamplifiers on aircraft UHF receivers, which is scheduled for all ARS search aircraft in the not too distant future.

Recent tests conducted on the URT-21 at the 55th Air Rescue Squadron in Bermuda give an indication of what a difference a pre-amp can make. At 10,000 feet the tone signal could be picked up at 70 miles with the UHF-DF reaching out 41 miles on voice with pre-amp turned off. With the pre-amp turned on, the tone came in loud and clear at over 120 miles while, for some mysterious reason, the UHF/DF range dropped to 35 miles. At 20,000 feet the tone could be picked up without the pre-amp at 75 miles; the UHF/DF at 50; with the pre-amp on, the tone was picked up at 138 miles, the UHF/DF at 54.

Another electronic device that has been needed for years—the crash locator beacon—may soon make the scene in spite of everything. Still in the development state, it is presently being tested on MATS C-135 and C-133 aircraft. ARS is scheduled to perform the search phase of these tests in the near future. It is possible that these or similar beacons will become an integral part of some USAF aircraft either by design or modification. Ejected automatically should an aircraft crash, they can also be ejected manually by the pilot in an extreme emergency.

This program has been evolving for more than a decade and has been constantly complicated by a variety of requirements for more and more sophistication such as



an is tiny, the ocean ıge. To save your life ou should be prepared to elp Rescue Help You.

Help Rescue... continued

building complex flight data recorders into the system. Moreover, the problems associated with configurating each aircraft type to accept the beacon without degradation of performance will be a time consuming task. In all probability if USAF today procured a straight crash locator beacon with no frills or fancy adornments, it would take at least two years to equip the USAF inventory across the board.

Besides radios a number of other gizmos and bits of equipment are being developed to make it easier for you to help Rescue help you. For one thing the little grey, one cell emergency flashlight that has been with us so long will soon be on the way out. To this end a new survivor recognition light, the SDU-5E, light, distress marker, is currently being procured. They will be issued on the basis of one survival light per parachute or flight suit. Weighing seven and a half ounces and measuring four and a half to two and a half by one inch, the SDU-5E puts forth a flashing strobe light visible over three miles from 1500 feet. Close in on a dark night it will literally jolt your eyeballs.

The search goes on for new and improved survival kit flares and tests are now being conducted on a small hand-held flare launcher. This launcher is capable of tossing multi-colored light, smoke or noise flares to an altitude of 300 feet. From ground level the light flares are visible up to seven miles. About the size of a fountain pen, this flare launcher is designed to be carried by the individual crewmember.

Taking a completely different approach, ARS has submitted a qualitative operational requirement for sound fixing and ranging (SOFAR) equipment. It is a deep water location device valuable only in ocean areas. SOFAR charges will not explode in fires and must be hydrostatically activated. They are small—can be carried in a navigator's kit—have indefinite shelf life and need no fancy installation.

Essentially this SOFAR system consists of a depth charge that detonates automatically at a specific depth below the ocean's surface as the aircraft wreckage sinks after ditching. The detonation sets up a distinctive sound pattern that radiates in all directions through the water from the point of origin. At these specified levels sound travels thousands of miles and can be detected by underwater listening stations. The signal strength determines the range and its origin can be fixed within a few miles by triangulation from various listening stations. This technique, used successfully during Project Mercury on Scott Carpenter's flight, could quickly limit or confine an overwater search to a relatively small area.

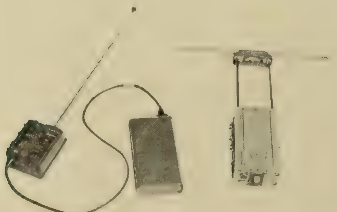
These examples represent neither the extent nor the end of Air Force efforts to help the guy in trouble help ARS. Also in the mill, for example, is some chemical gunk that will make the time tested fluorine sea dye as antiquated as buggy whips and button shoes. (In this area our lips are sealed for the present.—Editor's Note.)

There is an old story about the farmer who was trying to teach a city boy how to handle a mule. His first move was to pick up a five-foot chunk of two by four and give the mule a heck of a belt right between the eyes. "First," he said to the city slicker, "you gotta get his attention." The purpose of all the new aforementioned gadgetry is just that — to get the would-be rescuers' attention. Once this is accomplished, help should be on the scene in a little or no time. But the battle is still not over.

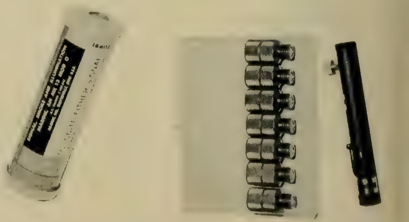
Be prepared when help arrives to assist in ever way. Even when Rescue is in the area and has yo spotted, minutes still can easily mean lives. Know how to use your emergency signal and radio equipment quickly and effectively. Know what constitute a suitable helicopter landing area and mark it.

Dust, sand, loose snow can blind a chopper pilo and make a tough pickup even tougher. Realize tha innocent-looking bushes and scrub growth can pla hob with a tail-rotor, and that it will do you no goo to stay alive for days only to be knocked completel out of this bright blue-eyed world in an instant b getting excited and trying to run through that sam tail-rotor.

Rescue missions are flown every day in all weather under every climatic condition. The men who fly thes missions get to see first-hand the grim results of failur to plan, lack of knowledge and preparedness. Don' learn the hard way that Rescue can only help you i you help yourself. ☆



Survival kits usually contain one of these survival radios, URC-11 (left), URC-4 (right). In cold weather batteries should be kept warm. PE shops should check batteries regularly.



MK 13 flare and pen gun flare provide downed person wit means of attracting attention of rescuers. MK 13 is standar survival kit item, pen gun is authorized for local purchase

FAA ADVISORIES

Robert L. Terneuzen
FAA Liaison Officer
Directorate of
Aerospace Safety

SPECIAL USE CHANNELS — Effective July 1, 1964, Special Use Frequencies 296.7, 364.8, 369.9 and 321.3 mcs are direct controller-to-pilot communications channels. They were established to minimize frequency changes in order to provide an additional degree of safety to specific single pilot jet aircraft while in formation flight. These frequencies are to be used within the ARTC Center area of jurisdiction at FL-240 and above. Aircraft authorized to use Special Use Frequencies are:

USAF Strategic Air Command (SAC) B-58 aircraft while operating on an instrument flight rule flight plan when flying at supersonic speeds.

USAF Tactical Air Command (TAC), U. S. Navy and Air National Guard (ANG) single pilot jet aircraft formations operating at night or in instrument weather conditions. (Note: "Single Pilot Jet Aircraft" includes RB-66, F-100, F-102, F-4, A-1, A-4, TF-9, etc.)

ASSIGNMENT OF FREQUENCIES:

A. Special Use Frequencies are assigned to ARTC Centers in such a manner that adjacent Centers will not have the same frequency, thus minimizing radio interference.

B. The Special Use Frequencies assigned to each ARTC Center shall be shared by all high altitude sectors within that Center's area.

C. Controllers may not always know when a flight is operating in instrument conditions; therefore, pilots of aircraft in the above categories will request a Special Use Frequency by radio prior to encountering instrument conditions or entering supersonic flight (B-58). A Special Use Frequency should always be assigned by the controller during hours of darkness. Aircraft operating in Special Operating Areas (SOA), except en route aircraft flying through an SOA, shall not be assigned a Special Use Frequency. Controllers shall comply with pilot requests for a Special Use Frequency unless, in their opinion, use of this frequency would result in an emergency control situation.

D. It is not intended that priority handling shall be afforded aircraft using the Special Use Frequencies except in emergency situations.

E. A controller may assign the Special Use Frequency as "back-up" for the high altitude sector ultra high frequency (UHF) when direct controller-to-pilot communications are essential because of a potential emergency control situation.

F. Information concerning these frequencies shall not be depicted on aeronautical charts or publications since the primary function is limited to selected flights.

AVOIDING SEVERE WEATHER

Radar has become a valuable tool for use in the prevention of aircraft accidents. One way in which this tool is used is in vectoring aircraft away from areas of severe weather. It has its limitations, however, and there is evidence that some pilots do not appreciate these limitations or exactly the kind of aid they should expect from FAA controllers using radar.

Controllers assist pilots, particularly those on IFR flight plans, in avoiding areas of known severe weather. But there are times when the controller is limited in the assistance he can provide. First, it should be realized that his primary responsibility is the safe separation of aircraft. Then, work load and limitations of his equipment may reduce his capability to provide any additional service.

One thing pilots must realize is that radar does not "see" turbulence. It sees only areas of significant precipitation which are generally associated with turbulence. There is no operational equipment yet that sees turbulence as such.

With the above points in mind here are some suggestions for pilots:

- Penetrate thunderstorms only when there is no other choice.
- Report to ATC any severe weather encountered giving nature, location, route, altitude and intensity.
- Request assistance in avoiding severe weather as soon as possible, being specific concerning route and altitude desired. Review the Flight Information Manual pertaining to "Detouring Thunderstorms" and "SIGMET Procedure."
- Adjust speed as necessary to maintain adequate control of aircraft in turbulent air and advise ATC as soon as possible.
- Do not rely completely on air traffic controllers to provide information or to initiate radar vectors to aircraft for avoidance of severe weather, particularly when arriving and departing terminals or in holding patterns.
- Plan ahead to anticipate the need for avoiding areas of known severe weather. If necessary, delay takeoff or landing, as applicable.

BOAT SAFELY

Charles W. Russell
Asst. National Director, Small Craft
The American National Red Cross

When 10,000,000 persons using some 8,000,000 boats ply America's coastal waters, rivers, reservoirs, and lakes this year, some avoidable accidents are going to occur. These accidents, most often, are the result of lack of knowledge and skill.

Although courses in boating techniques are offered, without charge, by the U. S. Coast Guard Auxiliary, U. S. Power Squadrons and the American Red Cross, among others, it is an acknowledged fact that, as of this time, the majority of boat operators will not avail themselves of this formal instruction. Furthermore, it is also recognized that many of these people cannot swim, or swim well enough to save their lives. It is for this reason that every means of conveying safe boating information to the public is used in an attempt to reduce the needless loss of life and property.

Capsizing and falling overboard are the causes of 65 per cent of the fatal boating accidents. Add to these two causes the third main cause, foundering, or sinking, and 85 per cent of all boating accidents can be accounted for. One can only draw the inference from these facts that the main cause of fatalities in boating accidents is the inability to swim — to take care of oneself in the water when separated from the boat. Falling overboard, capsizing, or sinking are not, in themselves, fatal occurrences.

In the case of swamping or capsizing, the best advice is to stay with the boat unless it is being carried toward potentially dangerous areas such as waterfalls, dams, breaking surf, or water intakes of hydroelectric plants. When water temperatures are extremely cold, it may be advisable to attempt to swim for shore. In all cases, lifesaving gear should be used if leaving the boat is indicated.

Many of the fatalities caused by falling overboard occur while the boat is moored, before the passengers have an opportunity to adjust to the comparatively unstable footing conditions that exist in small boats. Most, however, are caused by unsafe procedures while the boat is underway. Such unsafe practices include sitting on gunwales and decks, standing or moving about without holding on, turning tightly at high speeds without warning passengers, and slipping on oily or uneven sur-

Aboard boat all children should wear life preservers. (American Red Cross photos.)

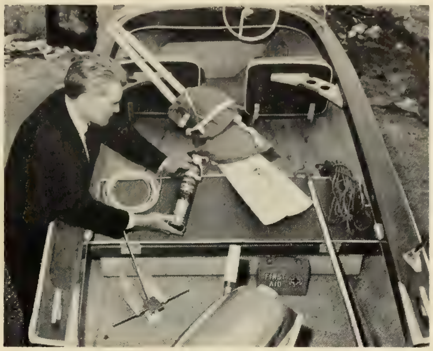
faces. Wearing unsafe foot gear and engaging in horseplay are also frequent causes of falling overboard accidents.

Experienced skippers know the importance of keeping equipment and gear in excellent condition and ready for use. They also require those on board to abide by established safety procedures. It is essential for the operator to know beforehand the swimming capabilities of all on board and to insist that weak or non-swimmers wear an approved lifesaving device.

If a passenger falls overboard, the rescue procedure is based upon the ability — or inability — of the person in the water to help himself, and to a lesser degree, on weather and visibility conditions. Two basic techniques are used:

First — and the method of choice —is to toss a lifesaving device toward the victim, make the boat dead in the water, and have the victim swim to the boat.

The other method of rescue is to maneuver the boat back to the victim if there is any doubt about his ability to care for himself in the water. Swing the stern away from the side the victim falls from to reduce the danger of propeller injury. Stop the boat, and toss a lifesaving device toward the victim before turning the boat. Keep a close watch on him at all times and make the approach as you would a mooring—at low speed and slightly to windward if possible. Shut off the motor when the boat is within a few feet of the victim. The propellers can spin fast enough to cause an injury even when the gear shift is in neutral.



Some safety gear is required such as stern light, lower right of picture, and a life jacket for each passenger. Recommended for Class A boats are fire extinguishers (held by the author), oars, a signal whistle (lying on the oars), boathook, extra line, anchor, first aid kit, spare can of gasoline.

Here are some of the basic rules of boating safety which the careful skipper will always observe:

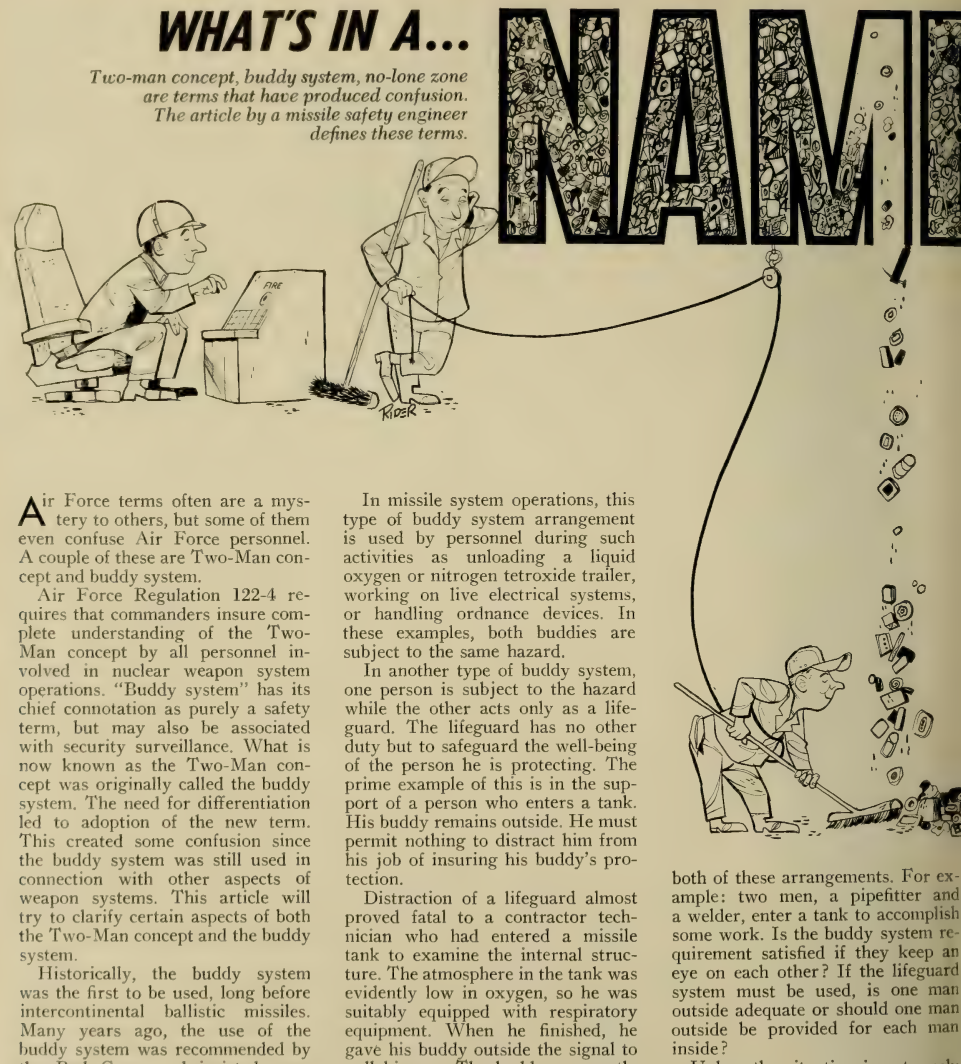
- Be sure everyone in the boat knows how to swim. If you have a non-swimmer aboard, make him wear a life jacket.
- Don't overpower your boat. Your dealer can tell you the safe size of motors.
- Don't overload your boat. Keep passengers down to a safe number.
- Equip your boat with such safety items aboard as anchor, oars, boathook, extra line, fire extinguisher, tool kit, first aid kit, and a life jacket for every passenger.
- Running lights are a must for operation at night.
- Check U. S. Weather Bureau forecasts before taking your boat in open water. If you are going far, take along a transistor radio to keep you posted on the weather.
- Don't smoke while refueling.

Good manners and observance of the "Rules of the Road" are essential to safe boating. These rules are:

1. When boats approach each other at an angle, the boat on the right has the right of way, the boat on the left must yield.
2. Rowboats have right of way over power or sailboats.
3. Sailboats have right of way over power boats.
4. Boats being overtaken have the right of way. ☆

Short turns at high speed can cause boat to capsize.

WHAT'S IN A...



Two-man concept, buddy system, no-lone zone are terms that have produced confusion. The article by a missile safety engineer defines these terms.

Air Force terms often are a mystery to others, but some of them even confuse Air Force personnel. A couple of these are Two-Man concept and buddy system.

Air Force Regulation 122-4 requires that commanders insure complete understanding of the Two-Man concept by all personnel involved in nuclear weapon system operations. "Buddy system" has its chief connotation as purely a safety term, but may also be associated with security surveillance. What is now known as the Two-Man concept was originally called the buddy system. The need for differentiation led to adoption of the new term. This created some confusion since the buddy system was still used in connection with other aspects of weapon systems. This article will try to clarify certain aspects of both the Two-Man concept and the buddy system.

Historically, the buddy system was the first to be used, long before intercontinental ballistic missiles. Many years ago, the use of the buddy system was recommended by the Red Cross and insisted upon by Boy and Girl Scout organizations whenever anyone went swimming or participated in any potentially hazardous activity. Both persons in this type of buddy system arrangement were subject to the same hazard at the same time. Each had to assure the well-being of the other and provide any necessary assistance in the event of a mishap.

In missile system operations, this type of buddy system arrangement is used by personnel during such activities as unloading a liquid oxygen or nitrogen tetroxide trailer, working on live electrical systems, or handling ordnance devices. In these examples, both buddies are subject to the same hazard.

In another type of buddy system, one person is subject to the hazard while the other acts only as a lifeguard. The lifeguard has no other duty but to safeguard the well-being of the person he is protecting. The prime example of this is in the support of a person who enters a tank. His buddy remains outside. He must permit nothing to distract him from his job of insuring his buddy's protection.

Distraction of a lifeguard almost proved fatal to a contractor technician who had entered a missile tank to examine the internal structure. The atmosphere in the tank was evidently low in oxygen, so he was suitably equipped with respiratory equipment. When he finished, he gave his buddy outside the signal to pull him up. The buddy apparently was concerned elsewhere, so the man in the tank shouted to attract his attention. To do this, he had to remove his facepiece, take a breath, shout and then replace his mask. After being assisted from the tank, he took two steps and collapsed. Luckily an inhalator was available and he was revived immediately.

Sometimes questions arise about both of these arrangements. For example: two men, a pipefitter and a welder, enter a tank to accomplish some work. Is the buddy system requirement satisfied if they keep an eye on each other? If the lifeguard system must be used, is one man outside adequate or should one man outside be provided for each man inside?

Unless the situation is extremely hazardous, one man outside the tank should be adequate. The probability that a mishap will occur to both persons in the tank is extremely low (though possible). In case of a mishap to one, the other and the outside man can remove the affected person. Additional personnel outside would certainly be helpful, but not absolutely necessary. The outside

Willie Hammer
Directorate of
Aerospace Safety

worker can use prearranged signals, a whistle or some type of electrical communication to attract attention in time of need.

In security practice, the buddy system may also be used as a safety measure in areas where air policemen may be assigned to remote, lonely or dangerous duties. Its use in security also permits mutual surveillance to be maintained in areas where lone access is not authorized.

The Two-Man concept is a measure involving access to nuclear weapons or nuclear weapon systems to prevent degradation of reliability, safety, or security. As mentioned in AFR 122-4, compliance minimizes "the opportunity for incorrect or unauthorized procedures which could result in premature arming, launching, firing, or releasing of a nuclear weapon by one person." Each of the two or more persons present under this concept must be capable of detecting incorrect or unauthorized procedures with respect to the task to be performed. (This does not require persons having "equal" knowledge; only the capability of detecting incorrect or unauthorized procedures.) This is in contrast to the buddy system in which personnel involved must be able only to recognize that the other person is in physical distress and to provide assistance.

The occasion may arise where access to certain areas in a structure may be restricted for security or safety reasons. Areas so restricted to assure compliance with the Two-Man policy are called no-lone zones. In some instances, the designation no-lone zone has been extended to limit access to equipment which if disabled would prevent accomplishment of the weapon system mission. Only authorized personnel, with a valid requirement, may enter these areas, and only when two or more are present. Men safeguarding each other under the buddy system do not satisfy the requirement for entry into a no-lone zone. On the other hand, each of the buddies may assure that the other does not enter such a zone.

Remember: Enter a no-lone zone only when authorized and when accompanied by at least one other qualified and authorized person. If two such persons are in a no-lone zone and, for some reason, one must leave, the other is obligated to leave, too. Operations performed must be authorized and must follow prescribed procedures. Both members of a Two-Man team must be in positions where each can determine whether any errors or unauthorized deviations are taking place in the task being accomplished.

The buddy system and Two-Man concept have one thing in common: the need for undivided attention to the task being performed. AFM 127-201 prescribes that when the buddy system is used, constant communication will be maintained between the persons involved. A person in a hazardous situation will remain within sight of his buddy at all times or otherwise maintain communication to indicate his well-being. Where a person is acting as a lifeguard outside a tank for a man inside, he will be given no other duty.

Personnel supervising operations in which the buddy system is to be used should indicate clearly what each person is to do. When in doubt as to the type of buddy-system arrangement which should be used, the safety officer should be consulted. Buddies must know the hazards involved in any operation, their duties as buddies, how to use prescribed rescue equipment, and emergency procedures, including artificial respiration. They must know all these before they take part in any hazardous operation. There is no time to learn them once the emergency arises. Supervisors must make certain buddies are equipped with necessary protective and rescue equipment before the operation begins.

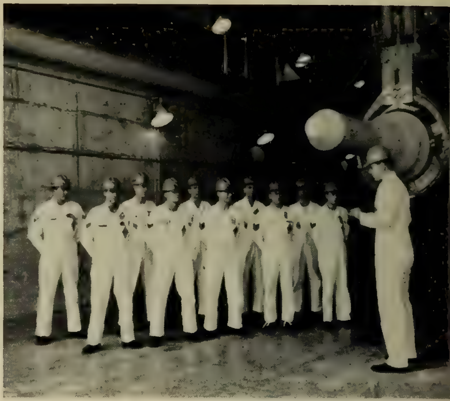
Additional information regarding the Two-Man concept is contained in AFM 122-1. Personnel responsible for members of Two-Man teams, and the members themselves, should be familiar with the provisions of this manual. They should be familiar with and capable of performing prescribed procedures. In the event any person assigned to a task requiring a Two-Man team believes his knowledge or experience is inadequate to detect incorrect or unauthorized procedures, he should request replacement.

By keeping the well-being of the other fellow and of your country always in mind, you will be not only a buddy, but a pal. ☆

CANOPY JETTISON

Since the publication of "Jet Fighter Canopy Jettison" by Capt Donald H. Volz in the June AEROSPACE SAFETY, questions have been raised as to whether the procedure for retaining the canopy applies to off-base as well as on-base emergency landings. Off-base crash landings are generally more destructive, thereby increasing the probability of injury to the crewmember or damage to canopy release mechanisms. Also, crash rescue facilities are not as readily available. However, as in the case of an on-base emergency landing, the canopy affords temporary protection against heat, explosion and fire and provides additional time for the pilot to free personal leads and to evaluate the situation. Therefore the procedure for retaining the canopy applies to off- as well as on-base crash landings. It is anticipated that applicable aircraft Dash Ones will be revised in the near future to include this recommendation.

MISSILANEA



AGM-28 LOADING INCIDENT—A flight line tug was being used to position an AGM-28A under the wing of a B-52G in preparation for uploading. The missile was mounted on an H2-33-A trailer. After the missile was towed under the aircraft, the tug was disconnected from the tow bar and reversed in order to hook the tow bar in front of the tug. This allowed the tug operator to observe the directions and receive the orders of the uploading crew supervisor.

While positioning the trailer with the tug, the trailer tow bar was moved to approximately a 45-degree angle to the trailer and the tug became positioned at approximately a 45-degree angle to the tow bar (90 degrees to missile center line). This placed the front radiator guard of the tug in close proximity to the missile engine exhaust tail cone. The tug lurched forward and struck the exhaust tail cone, inflicting damage.

Investigation of the incident revealed that the tow bar on the H2-33-A trailer was not extended to provide adequate clearance between the engine exhaust tail cone and the front of the tractor. Paragraph 3 - 5P, Sec III, T.O. 21-AGM-28A-2-2 requires that trailer tow bar be extended to provide adequate clearance prior to attaching the tow bar to the tug. The H2-33-A positioning trailer being used had no capability for manual steering since the steering attachment lug on the front of the trailer had broken prior to this incident.

Maj. Edward D. Jenkins
Directorate of Aerospace Safety

SCAPE Notes. Humans, being rather tender, have to resort to the use of protective devices and clothing during certain occupations. An example of this clothing is the SCAPE used during transfers of Titan II propellants. Following are some safety slanted items about the suit, as noted by the Martin Company (Denver Division).

Each prospective user of the SCAPE must be certified in its use prior to wearing it under work conditions.

The primary hazard is the possibility of exhausting the supply of breathing air while in a precarious position or while performing a hazardous operation. To avoid this the minimum amount of liquid air in the unit should be measured by weight, then use of the unit timed and the user summoned to the change house in plenty of time to avoid running out of air. Warnings to the user or his buddy that air is running low include a change in sound made by the environmental unit; fogging of the face plate; deflation of the suit and clinging to the limbs as air decreases; difficulty in getting enough oxygen.

It is possible that components of the environmental unit might freeze, causing the user to suffer cryogenic burns. Indications prior to freeze-up are:

- Approximately five to eight minutes prior to freeze-up, a cracking sound will be heard as a result of heat-exchanger sump freeze-up. The plastic cover over the sump assembly will also freeze and begin popping at this time.
- Approximately three to five minutes prior to freeze-up, a sputtering, spitting sound will be obvious.
- Approximately two to three minutes prior to freeze-up, the air distribution panel, located on the wearer's lower left abdominal region, becomes exceedingly cold. The panel becomes so cold, in fact, that if the subject has on the properly prescribed underclothing, it will be impossible for him to wear the unit until he sustains a burn. He will have to remove it.

Other suggestions concerning wearing of SCAPE equipment are:

- As additional protection against cryogenic burns, individuals should wear a multi-folded towel covering the posterior from the waist to the lower part of the buttocks.
- It is essential that only the designed underclothing be worn while wearing the SCAPE.
- Always use handrails while climbing ladders. Watch for step-offs (holes, voids in work platforms). Never use without a buddy present. ☆

HIGH

LOW

ZERO

Reprinted from AIRSCOOP, March 1964.

From 1 January through November 1963, USAFE units equipped with aircraft utilizing J-57 engines reported 95 precautionary landings due to oil system abnormalities. Of this number, over half (50) proved to be malfunctions of the indicating system. A break-out by type aircraft looks like this:

F-100	
REAL 15	FALSE 11
F/RF-101	
REAL 19	FALSE 19
F-102	
REAL 11	FALSE 20

Abnormal oil pressure readings are always a source of consternation to pilots, especially those with only one engine providing the locomotion. Very often, faulty relief valves or transmitters have caused erratic or erroneous readings, but to the pilot, it makes little difference. There is no way to detect a faulty indicating system while airborne. So, he must treat the occurence as the real thing, with engine failure some unknown number of minutes away.

The question often asked is how long will a particular engine run without lubrication to the bearings? The straight answer is you can't tell. There are too many variables . . . many of them unknown. There are cases on record where individual engines have run as long as 30 to 45 minutes. However, it appears that some lubrication had to be reaching the bearings.

There is one case on record where a J-57-P21 engine ran for 20 minutes on a test run with absolutely no oil reaching the bearings (a small plastic dust plug was found in the main oil pressure line). The Nr 4, 4½, 5 and 6 bearings never got any oil. The 20 minute run consisted of five minutes at Idle, 10 minutes at Mil Thrust for stabilization and trimming, five minutes at Idle and 30 seconds at Mil Thrust again when an explosive sound was heard . . . a severe compressor stall.

Compressor stalls often result from oil starvation for this reason: As bearing friction increases, slowing the N_2 turbine, the fuel control automatically compensates for this by delivering more fuel to the engine in an attempt to maintain that speed selected by throttle position. This, of course, can't continue for long. The process of increasing fuel flow to maintain the lagging RPM will eventually lead to severe overtemperature conditions and turbine distress. Then, when the selected RPM can no longer be maintained by fuel flow increases, compressor mismatch develops (N_1 - N_2 airflow incompatibility) which results in compressor stall. This is what happened in the preceding case.

That engine ran for 20 minutes. It would be great if we could count on all of them running that long. Unfortunately, for every one that does, there are many that quit early. Take the case of the F-102 driver on climbout. When passing 40,000 feet, AC power failed. Fifteen seconds later the oil pressure warning

continued on next page

A scene like the one above may result when the oil pressure drops but may be prevented by a previously determined course of action.

LOW HIGH ZERO

continued

light came on. At this point he reduced power to 85 per cent. All engine readings appeared normal. Three minutes later the engine began to vibrate, accompanied by compressor stalls. The pilot ejected successfully. Later it was determined that the Nr 4 bearing (thrust bearing) failed from oil starvation.

The time element then, depends upon operating conditions at and immediately after the time oil starvation occurs, as well as such things as condition of the bearings prior to oil starvation, operating temperatures of the bearings, and bearing loads. Engine operation is possible for a limited time at reduced thrust (such as cruise) with little or no oil pressure. However, at high thrust, operation for more than a few minutes is doubtful.

The events that take place within the engine go something like this: With little or no oil pressure, bearing temperatures begin to rise, since much of the normal engine oil circulation is required for bearing cooling. Failure of the bearings themselves begins slowly and will normally continue at a slow rate (depending on power setting) up to a certain point. As the bearings become overheated, however, the progression of failure accelerates rapidly. Usually the first bearing to fail will be the thrust bearing, because of highest loading. When it begins to go, vibration can usually be detected and may be accompanied by rising EGT and compressor stalls, for the reasons mentioned earlier. When vibration becomes moderate to heavy, complete failure is only seconds away. The best course of action when this becomes noticeable is to stopcock to improve chances for a successful ejection or power-off landing. With failure of the thrust bearing, the compressors shift, causing simultaneous compressor/stator blade interference with resulting disintegration of the engine. Occasionally, failures of this type affect flight controls.

Let's talk about pilot actions when faced with no oil pressure. The Dash One says to reduce throttle.

'he reason for reducing power is
relieve the thrust and friction
ading on the bearings as much as
ossible while they are being un-
ernourished.

In this condition the pilot should
aintain altitude, if high enough
r a flameout landing, or zoom to a
easonable altitude, then proceed
SAP to a point from which a
nding can be made. While maneuv-
ring, G-loads should be kept at a
inimum. The throttle should be
oved only when absolutely neces-
ary and then slowly to relieve sud-
en bearing strain. In any event, it
hould not be reduced below a thrust
evel at which flight and landing can
e accomplished (80 to 85 per cent
eing optimum). In the pattern, slow
he aircraft by means of drag de-
ices rather than by throttle move-
ent. Retarding the throttle to a
ery low power setting may result
n the engine's inability to accelerate
f suddenly you find yourself short
n airspeed. So long as no vibration
r other indications of sudden fail-
re are detected, press on, but don't
et yourself get caught in a corner
f the engine comes unglued. Fly a
standard" final approach, and keep
0 kts extra for zoom and ejection.

Low oil pressure is only one step
emoved from zero. Only the time
lement is lengthened some unknown
mount. Pilot action is much the
ame. Namely, reduce power and
oint the nose toward the nearest
vailable airfield. The trouble with
ow readings is that the needle sel-
lom remains that way for long, but
ften unwinds and hits the peg.
ressures above 25 psi present no
mmediate threat *provided they re-*
ain constant. In fact, Pratt & Whit-
ey has stated that under *emergency*
onditions the mission may be con-
inued at T.O., and Military powers
o 30 psi minimum oil pressure,
nd at cruise power to 25 psi. This,
f course, is not recommended and
ppropriate Dash One corrective
ction should be followed to pre-
lude bearing damage. It does show,
owever, that the engine is not likely
o come apart before it can be
rought back for maintenance to
heck out.

Recently, a flight of two F-100s was on the return leg of a low level profile mission when Nr 2 noticed his oil pressure dropping from 45 to 20 psi. They were indicating 360 knots at 4000 feet . . . about 65 NM from the nearest airfield. Within two minutes pressure dropped to 6 psi with fluctuations to zero. The weather, as usual, was poor with two-tenths obscured, 1.7 NM in fog and haze. Power was maintained at 85 per cent. Utilizing radar steers and TACAN, the aircraft was flown toward a modified low key flameout position. At a point 12 to 15 NM out, engine vibration became noticeable. The wingman noticed smoke belching from the tailpipe. A righthand turn was made to final from the 270 degree point and a successful landing accomplished with the engine stopcocked on the roll.

This one was close! A partial teardown of the engine revealed the Nr 4 bearing completely shot, with Nr 4½ and 5 bearings dry and heat discolored. Surprising as it was, the engine had not seized, but the charred and dusty condition of the thrust bearing indicated complete rotor seizure was only seconds away. When the pilot first noted the gage, it was low and falling. The time element from this point to touchdown was between 15 and 20 minutes.

High oil pressure, although generally regarded as less serious in nature, can cause grief. It can mean a malfunction in the regulating and relief portion of the system, or it can mean a restriction in the system. A restriction could result in complete lack of lubrication to one or more bearings. If pressure is high, due to bearing cavity breather restrictions, a pressure build-up on the oil seals may cause them to pass oil, resulting in depletion of the oil supply. This type failure most generally results in smoke in the cockpit, if the seals leak forward of the 16th stage bleed air take off points. If the seals leak aft of this station, the oil, which is being pumped overboard past the turbines, will show up as white smoke.

What's a high reading? Well, according to the Dash One, anything over 50 psi is abnormal. However, under emergency conditions P & W has stated the mission may be continued with max oil pressures to 75 psi. Here again it's not recommended. The only reason for mentioning it is that people tend to clutch-up when the needle's out of the green area and have ruined them selves making desperation type approaches.

The only course of action open to the pilot caught with a high reading is to reduce power and try to bring the reading down to normal while heading home. He must, of course, be alert for indications that the engine is failing. So long as there are no such indications, the engine is not likely to cause trouble, but just as with low or zero pressure, it should be flown as though it might at any moment.

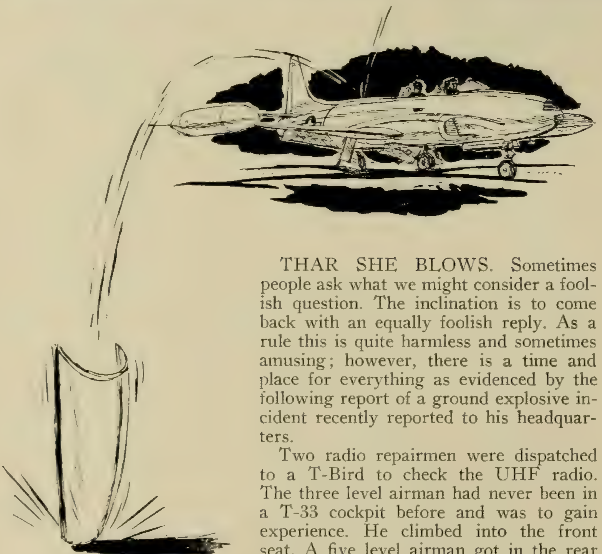
Since the end result of oil starvation is engine failure, the pilot's main interest should be to nurse the bearings along as much as possible until a landing can be made. While bringing it back, he should be alert for signs that indicate the engine's about to unstick. These are:

- Increasing Fuel Flow
- Rising EGT
- Decreasing RPM
- Compressor Stalls
- Smoke Emitting From Exhaust
- Moderate To Heavy Vibration

When vibration approaches the heavy stage, the best bet is to shut the engine down and either attempt a power-off landing or call it a day and step out. The chances of the engine running much longer are extremely doubtful and an explosive-type failure won't improve things.

To sum it up, if the malfunction is spotted early in the game, and if power can be adjusted smoothly to a setting that will allow flight to the nearest field, there is every reason to believe that the engine will hold together until a landing can be accomplished. If statistics mean anything, our experience has shown this to be true. ☆

Aerobits



THAR SHE BLOWS. Sometimes people ask what we might consider a foolish question. The inclination is to come back with an equally foolish reply. As a rule this is quite harmless and sometimes amusing; however, there is a time and place for everything as evidenced by the following report of a ground explosive incident recently reported to his headquarters.

Two radio repairmen were dispatched to a T-Bird to check the UHF radio. The three level airman had never been in a T-33 cockpit before and was to gain experience. He climbed into the front seat. A five level airman got in the rear seat. Since the wind was blowing, the airman in the rear seat closed the canopy. Subsequently, when the airman in the front seat wanted out of the aircraft, he looked around for a means of opening the canopy. He spotted the jettison handle, and, being completely unfamiliar with the T-33, thought this was the handle to open the canopy. He did ask the airman in the rear seat if the canopy would open if the canopy jettison handle were pulled. The airman in the rear seat jokingly replied, "Yes." The airman in the front seat then pulled the handle, the canopy jettisoned, blew back, separated at the hinges, struck the right side of the plenum chamber door and bounced forward off the aircraft, coming to rest on the ramp against the right side of the aircraft.

The airman in the rear seat, who was supposedly the supervisor, should have given the airman's question more serious consideration, particularly in view of his extremely limited experience. Another question that comes to mind is why the egress system ground safety pins were not installed. According to the Dash One, the initiator that provides the source of energy for canopy removal should have been safetied. Seems the responsible crew chief shares part of the blame for this needless incident.

If someone asks if the gun is loaded, assume he plans on shooting.

Robert H. Shannon
Directorate of Aerospace Safety

NAPALM DELIVERY—During a napalm delivery on a support mission the pilot of an F-84F reached down to position the compressor switch to ON as the aircraft approached the IP. Instead, he flipped the ATO ready switch thereby dropping two 150-gallon napalm tanks on the outboard racks. Fortunately the only damage was a slight fire in an unused field and fence damage caused by fire fighting equipment.

There were several reasons for this mishap, according to investigators. The ATO ready switch, normally safetied OFF, was not safetied because during a "Kids Day" demonstration, the safety wire had been removed and not replaced. Right next to the ATO switch is the compressor switch, which the pilot meant to actuate. The location of these switches led the investigators to find design deficiency as the primary cause.

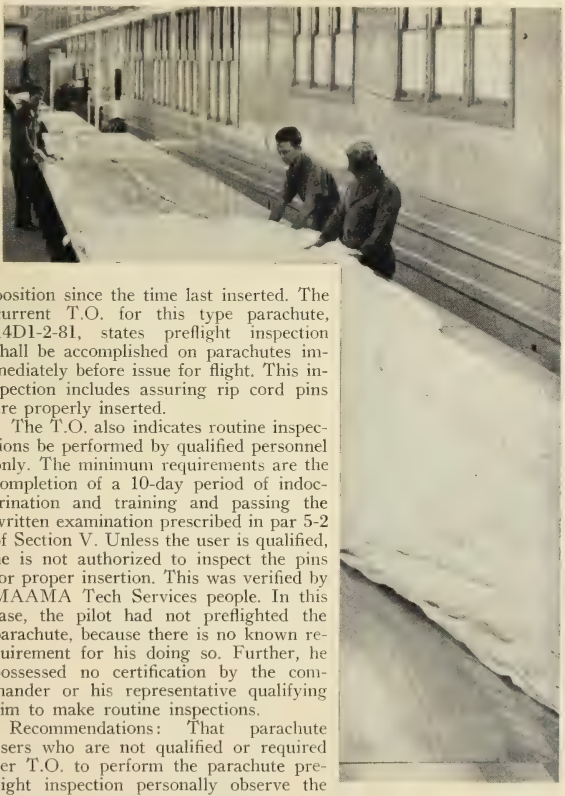
Contributing were the pilot's action in setting up the armament switches prior to reaching the IP, Maintenance for not resafetying the ATO switch, and both pilot and maintenance failure to catch the absent safety wire during preflight.

CHUTE INSPECTION. When was he last time you personally observed a preflight inspection of your parachute???

The following experience of a T-33 pilot emphasizes the need for constant vigilance in this area. This does not excuse P.E. people from their responsibility for thoroughly checking out equipment vital to life and limb. Had the pilot involved in this incident been faced with an emergency necessitating ejection, the odds are he would not have made it. With the pilot chute already out, it is quite likely that it would have entangled with the seat preventing separation. Also, n a low speed, low altitude ejection, you need all the pull you can get from a proper functioning pilot chute to get the main chute canopy out of the bag.

"During descent, I leaned forward in he rear cockpit of the T-33 to pick up a paper, and my chute deployed. After landng, I had Major .... (front seat pilot) look over all my equipment carefully before I moved anything. We could determine no reason for the deployment. The lanyard was hooked, but no cables were pulled. We took the chute out of he aircraft carefully and found the lower pin (of the two pins) was pulled, and the pilot chute was out of the pack. The upper pin was in place. We carried it in to the P.E. room, where the P.E. people moved t around and pulled the top pin out. The only part that was out of the pack was the pilot chute."

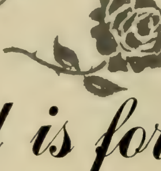
Tests made of back-style parachutes n order to duplicate occurrence showed he lower rip cord cable pin had to be partially inserted. The pin end or tip had o be resting on the inside diameter edge of the grommet before any flexing of the parachute would cause the pin to move and allow the tension on the locking loop o tilt the pin end through the grommet and permit the locking loop to slip off, esulting in chute deployment. The tests also indicated the pin had to be at this position since the time last inserted. The current T.O. for this type parachute, 14D1-2-81, states preflight inspection shall be accomplished on parachutes immediately before issue for flight. This inspection includes assuring rip cord pins are properly inserted.



The T.O. also indicates routine inspections be performed by qualified personnel only. The minimum requirements are the completion of a 10-day period of indoctrination and training and passing the written examination prescribed in par 5-2 of Section V. Unless the user is qualified, he is not authorized to inspect the pins for proper insertion. This was verified by MAAMA Tech Services people. In this case, the pilot had not preflighted the parachute, because there is no known requirement for his doing so. Further, he possessed no certification by the commander or his representative qualifying him to make routine inspections.

Recommendations: That parachute users who are not qualified or required per T.O. to perform the parachute preflight inspection personally observe the preflight inspection accomplished immediately before issue for flight. This is to assure users that pins are properly inserted and of condition and status of other items requiring preissue preflight inspection and setting.

NEW EXPLOSIVES SAFETY MANUAL—A revised Explosives Safety Manual, AFM 127-100, dated 20 April 1964, has been published. It provides an authoritative ready reference for all operations involving explosives. Publication of the manual represents Phase 2 of a three-phase program. The third phase will consist of refining the manual by amendment.



Red is for Roses

. . . AN OFF-COLOR STORY

Capt John T. Taylor, Flight Safety Div., Robins AFB, Ga.

When it comes to getting up before 0630, I'm like most — reluctant. So, when the phone jumps off the hook at the horrible hour of 0500, the little wife answers it. She can't stand ringing noises. It usually has to ring four or five times before yours truly is stirred from deep slumber.

On the morning of 25 January, my (censored) phone did ring at 0500. The wife answered and interrupted my peaceful sleep with words to the effect that an aircraft had been serviced with contaminated fuel. The words "contaminated fuel" will always jolt me to the wide-awake condition. The call was from Base Ops, and here is the story:

A DC-6 had been refueled during the predawn hours with a *red color* fuel. This, to say the least, caused some concern on the part of the crew. Most of us reciprocator types have been thoroughly brainwashed to accept only *purple-dyed* fuel, and fuel of another color is just out of the question!

Now the picture really gets involved! The true beginning of our story backs up a week or so to a depot project aircraft — a C-118—which had an elusive fuel leak. During the early morning hours, the work crew decided to add red aniline dye to the avgas (115/145) to aid in detecting and correcting this pesky leak. This did the trick. However, the troops overlooked one serious aspect: they failed to check for authority to add dye to avgas. T.O. 42B1-1-10 provides instructions and authority for dyeing JP-4 jet fuel for leak detection purposes but makes NO provision for using this same procedure for avgas. The dyed avgas was defueled from the C-118, and the defueling/refueling unit was isolated by POL pending word from the Chem Lab exonerating the avgas from contamination—a proper precaution on the part of POL.

The lab report indicated that the fuel was safe for use. POL proceeded to issue the avgas; and, at this point, communication was permitted to break down. Pilots were not informed of the dyed condition of the fuel! A lot of grief could have been avoided had the pilots or flight engineers been apprised of the additive dye and been given the option of accepting or refusing. This was not done, and the flight safety officer was awakened from peaceful slumber to look into the matter. The aircraft involved was defueled, and the familiar purple petrol was substituted. Samples of the red dyed 115/145 were forwarded to the base lab and exonerated with the exception of anti-knock rating. Anti-knock for our fuel samples was not altered.

The laboratory at MacDill has been requested by the base laboratory to add dye to 115/145 to determine the quantity of dye necessary to alter anti-knock characteristics of 115/145. When this has been determined, the prime AMA (Middletown) will be in a position to either authorize the dyeing of avgas for leak detection or prohibit such action.

At any rate, our POL Division has put out the word to this effect:

- Any request to defuel an aircraft containing grade 115/145 fuel other than the normal purple color will be refused pending investigation as to cause, purity, and if dye was added, by what authority.
- The POL foreman in charge will start the investigation by taking a sample of the fuel to determine if the color is other than normal. If so, he will immediately notify his section chief, flying safety officer, supply duty officer, and the Chief, Petroleum Branch.
- This is to advise that no authority or regulation exists at the present time authorizing additional dye to be added to 115/145 fuel to check for leaks. Aircraft Repair Branch is aware of this and has issued instructions to its organization that no more dye will be added to fuels, other than jet (JP-4), pending authority from Hq AFLC or MAAMA.

Our supply of off-color 115/145 avgas was exhausted by use in base assigned aircraft with the full concurrence of each pilot and Flight Safety and *only* after the anti-knock rating was determined "not affected" by the MacDill laboratory.

The crew which first detected the fuel in question filed an Operational Hazard Report which generated considerable corrective action locally, at AFLC, and MAAMA. Follow-up action is currently in the mill; however, it could happen elsewhere, which is why this short story was written. We sincerely hope that it will be passed to the appropriate agencies at your base to prevent your coming to grief with a similar problem. ☆

WELL DONE

1st Lt. GERALD M. MAY

PORTLAND AIR DEFENSE SECTOR (ADC), OREGON

On 20 March two F-102A's, Papa Lima 23 and 23A, were scrambled from Portland International Airport during a Division Tac Eval. The B-57 target was intercepted at 35,000 feet, 230 NM southwest of Portland, approximately 150 NM out over the Pacific Ocean. During the breakaway, PL 23 noticed his speed brakes would not retract. All emergency procedures failed to move the speed brakes from the full open position.

1st Lt Gerald M. May, the controlling Intercept Director at Portland Sector, was monitoring the conversation between PL 23 and 23A and realized the potential short-of-fuel situation developing. When it was determined that no emergency procedure would correct the situation, PL 23 requested RTB and a straight-in approach to Portland International Airport. Cloud cover was solid throughout the area up to 23,000 feet. Lt May began vectoring the aircraft toward home and advising the pilot how much time would elapse before touchdown.

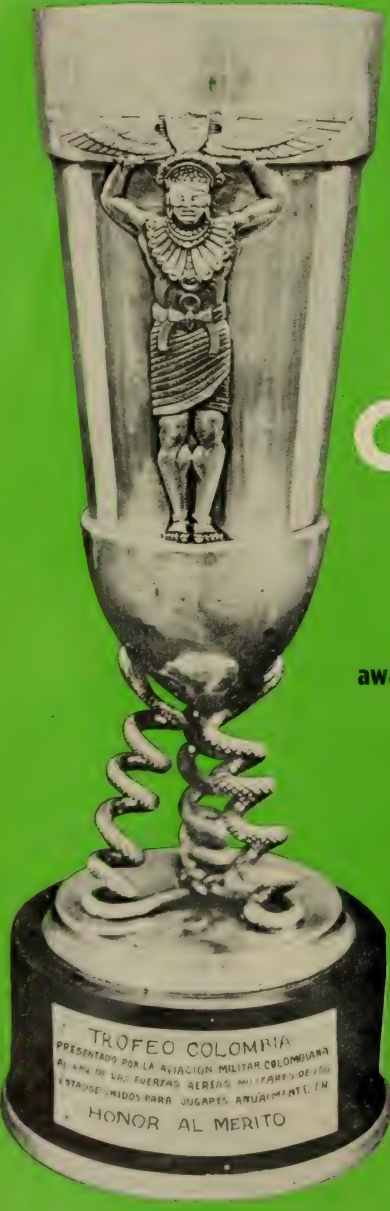
At approximately 175 NM southwest of Portland it was determined that fuel would not allow the aircraft to reach Portland. Lt May suggested the closest available airport was Newport, Oregon, with a 5100 foot hard surface runway. Newport weather was reported at 3500 feet overcast, ten miles visibility. PL 23 requested to land at Newport, but needed radar vectors to align with the runway since neither TACAN nor ILS was available.

Seattle Center was advised of the emergency and requested to clear all controlled traffic from the Newport area. PL 23 was now in a descent and in IFR conditions. Lt May, being an aero club pilot and having flown into Newport occasionally, gave PL 23 a complete rundown on local terrain features, angle and distance from town to the airport and suggested runway 20 for landing. Vectors were given for a right descending turn to line up with runway 20. Several 3500-foot hills surround the approach path, but Lt May vectored the aircraft clear of these hills and continued advising 23 he had adequate terrain clearance. Although weather had been reported as 3500-foot overcast, PL 23 reported that at 2000 feet he was still IFR. Lt May advised he was six miles out from touchdown and lined up with adequate terrain clearance. Descent was continued and at 1200 feet, 23 broke out, four miles out and lined up with runway 20. A successful landing was accomplished with less than 300 pounds of fuel remaining.

Lt May's timely and accurate analysis of the situation allowed him to give quick and accurate information to the pilot. His ability to think and act professionally in an emergency demanded complete confidence in his ability by the pilot and saved the Air Defense Command an interceptor and possibly a highly trained pilot. WELL DONE! ☆

COLOMBIAN TROPHY

awarded to the 45th Tactical Reconnaissance Squadron


TROFEO COLOMBIA
PRESENTADO POR LA AVIACION MILITAR COLOMBIANA
AL DE LAS FUERZAS AEREAS MILITARES DE LOS
ESTADOS UNIDOS PARA JUGARSE ANUALMENTE EN
HONOR AL MERITO

The 45 Tactical Reconnaissance Squadron, Misawa Air Base, Japan, has been awarded the Colombian Trophy for 1963 for meritorious achievement in flight safety.

In winning the trophy the squadron compiled more than 13,000 hours in RF-101 aircraft without a single major accident and has been accident free since September, 1961. During the award period, the squadron successfully conducted flights which included low level high speed navigation, long overwater flights, day and night air refueling and formation flying. Aircraft were deployed to locations over three thousand miles from the home station.

The safety achievement of the 45 Tactical Reconnaissance Squadron perpetuates the highest traditions and standards established for the Colombian Trophy and reflects great credit upon the 45 Tactical Reconnaissance Squadron, Pacific Air Forces and the United States Air Force. ☆

Lt Col James A. Bryant, Commander 45th Tactical Reconnaissance Squadron, Misawa AB, accepts Colombian Trophy for Flying Safety from Mr. Henrique Molano Campuzano, Republic of Colombia ambassador to Japan. Brig Gen Jay T. Robbins, USAF Director of Aerospace Safety, observes the presentation. He had just presented the squadron with a USAF Flying Safety Plaque.

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

SEPTEMBER 1964

READ

Out In The Breeze

page two

500,000 ACCIDENT·FREE HOURS

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AEROSPACE SAFETY

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AFRP 62-1 SEPTEMBER 1964 NUMBER 9

FALLOUT

SEEING TWO AS ONE

While reading the article "Eyes Outside" (May issue), the statement "Quick and accurate reporting is absolutely essential if the FAA and the military are going to keep abreast of hazardous or potentially hazardous airspace areas," stuck in my mind. It reminded me of two incidents that occurred at Brookley in 1958. I was a flight engineer on a C-47 out of Craig, standing in my usual place at the controls of the flaps and landing gear.

In the first incident, GCA was directing us out over the bay in heavy cloud cover, when suddenly we broke into clear sky. Directly in our path was a slower moving Gooney with one of the biggest tail sections I ever saw. The pilot nosed her over, I dropped the gear and we went under the unsuspecting crew of the other C-47. GCA's explanation was "We saw both of you as one aircraft."

The next one occurred around 1500 in a perfectly clear sky. We were banking to left from the east to come in over the hangar. Enjoying the clear view I spotted a T-29 (hospital ship) banking to his right from the west. I notified my pilot of the collision course with the T-29 and we continued our turn out of the pattern. To the best of my knowledge, neither incident was reported.

You'll probably say "but this happened six years ago." To me I now feel I've told someone who might be interested.

SSgt Armon B. Allen
Rantoul, Ill.

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500,000 ACCIDENT·FREE HOURS

A safety milestone was recorded on 21 July when the 1502 Air Transport Wing, MATS, completed 500,000 hours of flying without an accident. Fly- ig C-124s and C-118s, the present and previous mem- ers of the 1502d have realized an unprecedented chievement in the history of aviation safety. Most gnificant is the fact that, for over eight years, they elivered thousands of personnel and tons of vital cargo nroughout the free world without a single loss of life r aircraft.

This record attests to what can be accomplished by rofessional airmen, even when faced with such hazards s:

- Long range, over water missions with limited veather information and few emergency landing fields.
- Operational extremes that have included transi- ioning of aircraft and crews from 78-degree tempera- ures to minus 19 in a 30-hour period.
- Loss of two engines in flight.
- Runaway propellers at heavy gross weights and hundreds of miles from an emergency field.
- Continuous training and upgrading due to rotation of approximately one-third of the personnel each year.
- Congestion in the Honolulu area where operations in 1963 totaled 255,855 to rank 10th among all FAA operated terminals.
- Mission requirements ranging from daily passenger and cargo lift between the Pacific Coast and the Far East to night formation flying in heavy transport aircraft during tactical exercises.
- Operation on unfamiliar route structures on all continents except Antarctica and into strange fields throughout the world.
- Rapid reaction, irregular hours and long missions to provide airlift support in response to threats to peace throughout the free world.

The record of the 1502 Air Transport Wing stands as the strongest possible argument that complacency can be conquered, that standardization and training do pay off, that accidents can be prevented by professional airmen backed up by safety conscious supervisors and by dedicated support personnel. The half-million consecutive accident free hours flown by the 1502d is one of the singular achievements of military aviation and warrants the admiration of everyone in the United States Air Force. ☆

The back seat of the T-Bird is a drafty place, when the canopy goes. This article will give you an idea of what to expect should you find yourself

Pilots who have been in the back seat of the T-33 when the canopy let go in flight are quick to tell you that the experience is not only disconcerting but downright uncomfortable.

Sensations described include tremendous noise, precluding voice communication at speeds above 200 knots; violent buffeting of the body, with a resultant difficulty in manipulating the arms; flying debris in the cockpit, chill, and visual difficulties especially with the visor up. There is also a tendency toward disorientation.

Front seat pilots would have their problems too, as will be noted later.

Fortunately there have been very few canopies lost from T-Birds, but it can happen and has happened. A recent occurrence resulted in a fatal accident. The pilots, instructor in the rear and student in the front seat, were on a cross-country at night. The airspeed indicator had been acting erratically so the IP called for a chase aircraft at destination to lead him in for a landing.

Carefully then the IP prepared the student up front for the coming landing. He explained the situation and, because of light rain and a wet runway, informed the front seat occupant that the landing would be a little hotter than normal but that with 10,000 feet of runway there would be no problem. To be on the safe side, he told the student that, if it appeared necessary, he would request him to raise the canopy once they were on the ground to take advantage of the braking effect.

Moments later the canopy departed, in the words of the instructor, like an explosion.

The IP's first sensation was that there had been an explosion of some kind and that he was in his seat outside the aircraft. His helmet was pulled up against his chinstrap and his oxygen mask was over his right cheek. He repositioned his mask and helmet, then attempted to lower his seat. This took two try's.

By now he knew he was still in the aircraft and that it was not out of control. His next move was to bend over to the right of the stick to get out of the windblast. Airspeed was somewhere around 270 KIAS.

Symptoms reported were lack of ability to hear because of the windblast, visual difficulties, inability to keep his hand on the throttle because of the wind and inability to get his helmet visor down.

Finally, with the situation getting more desperate and with his inability to see or communicate with the front cockpit, the pilot ejected.

As a result of this accident a test flight was made by Lt Colonel Harry R. Bratt, chief of bioastronautics at the Air Force Flight Test Center at Edwards, and Major Donald M. Sorlie, chief of the manned spacecraft operations division. Both men are Command pilots. Major Sorlie occupied the front cockpit, with Lt Colonel Bratt in the rear. Both men were dressed in thermal underwear, heavy winter flight suits, leather gloves with woolen liners.

Takeoff was accomplished by Major Sorlie with Lt Colonel Bratt taking over at approximately 170 KIAS and 400 feet altitude. Lt Colonel Bratt's comments were:

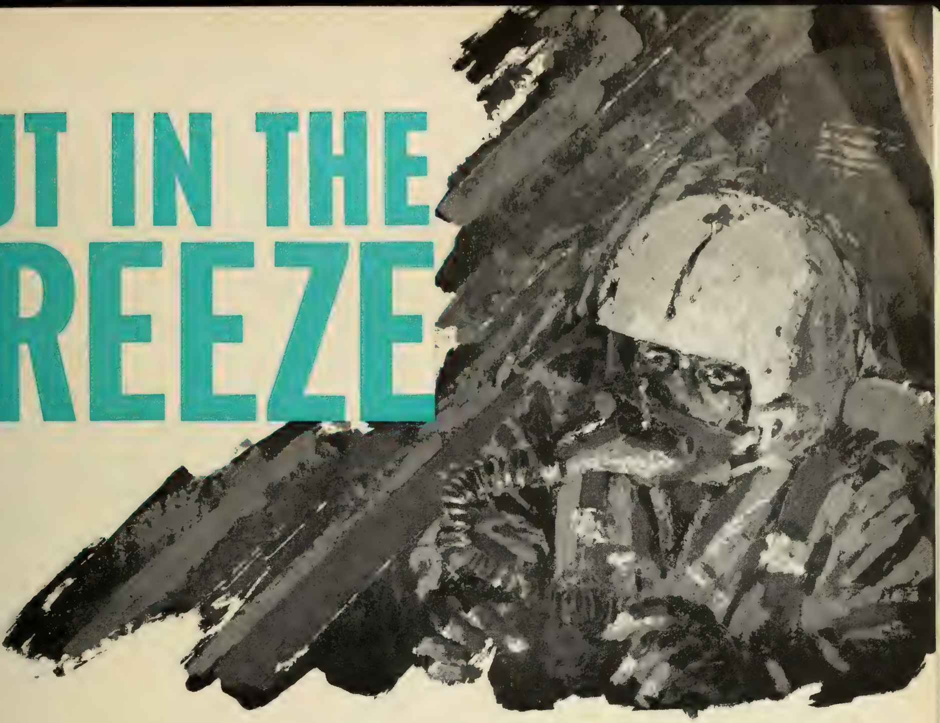
"Takeoff was accomplished with the helmet visor lowered. I had intended to raise the visor after takeoff, but after experiencing the windblast effects associated with the takeoff and acceleration to 200 KIAS, I abandoned this idea as impractical; that is, the windblast effects were so strong that I was convinced that the visor had to be in the lowered position to permit vision. Even with the visor lowered, the buffeting about the cheeks and eyes was very strong. Below 200 knots, audio reception by radio or intercom was poor, but understandable. At speeds in excess of 200 knots, the radio and intercom became unreadable because of the external noise.

"Beginning at approximately 200 knots, high-frequency head buffeting produced the visual impression of 'dancing' of the instrument numerals and indicating needles. This phenomenon increased in severity with increasing airspeed. At no time was I unable to correctly read the instruments or scan the panel. At no time did the apparent movement of the instruments attain an amplitude or frequency such that blurring of vision occurred, although double-images were constantly present when observing cockpit instruments and controls at speeds in excess of 200 knots. Distant vision was not affected.

"Extreme cold began to be noticed between 10,000 and 20,000 feet MSL (outside air temperature —11°F). My fingers, cheeks, and nose became very painful and the tips of my fingers became numb after about two minutes above 10,000 feet MSL. My hands became stiff and clumsy. I was able to manipulate the card of the J-8 compass, but with difficulty. I would estimate that it took two to three times as long as usual to rotate the card from the outbound to the inbound heading. The same comments apply to manipulation of the UHF and VOR tuning controls. Feet, body, and upper arms were uncomfortably cold, but tolerably so. The numbness of my finger tips convinced me that the threshold of tolerance had been exceeded and that continued exposure could result in frostbite.

"The level flight acceleration at 5000 feet MSL was terminated at 270 knots. Buffeting, although severe, was tolerable, and I felt that I could tolerate an additional 20 knots, without difficulty. At 270 knots, however, I was unable to hold my back forcibly against the seat

OUT IN THE BREEZE



back-rest because of the forward pressure of the air circulation. This was in spite of having the shoulder harness tightened more than I customarily use in routine flying. Since bending forward in the cockpit exposed the back of the parachute to the slip stream, I became greatly concerned about the possibility of windblast deploying the parachute and terminated the acceleration at 270 knots and did not voluntarily exceed 220 knots."

Major Sorlie commented: "The helmet visor was placed in the down position during the entire flight. Although both cockpits were cleared of extraneous material prior to flight, considerable cockpit residue was encountered on takeoff. Some of this residue lodged in my eyes. No windblast effects were noted, due to the protection of the forward wind screen. Some venturi effect was encountered from between the pilot's legs, flowing upward between the pilot and instrument panel. The intensity of this venturi effect increased with increasing speed, but was tolerable with the visor down. Hands were held to the opening between the helmet visor and mask to prevent the irritating effect of wind entering behind the visor. No numbing effects were noted due to cold, as experienced by the rear cockpit pilot. While in the traffic pattern, the rear cockpit pilot had difficulty actuating the landing gear lever, and the gear was actuated from the front cockpit. The approach and landing were uneventful. The rear pilot had a tendency to level off slightly high but touchdown was smooth. The VOR—ILS-ADF was inoperative due to canopy removal."

As a result of this flight Lt Colonel Bratt's conclusions were as follows.

1. The direct windblast effects on the rear seat occupant preclude useful vision, unless the helmet visor is lowered. At night, the combination of reduced light transmission through the lowered visor and the effects of buffeting in degrading visual acuity could readily lead to spatial disorientation.

2. Audio reception at the lowest possible airspeeds (130-140 knots) for good control is marginal and is impossible at airspeeds in excess of 200 knots.

3. As pilots customarily dress for flying the T-33, the effects of cold would be intolerable with air temperatures at or below freezing.

4. Landing the T-33 at night from the rear cockpit with the canopy off would be equivalent to an extremely low visibility instrument weather approach in which only the runway lights were visible. The pilot would require glide slope and azimuth information, either by ILS or GCA, on the final approach.

In addition Major Sorlie was of the opinion that: "Landing of the aircraft would have been marginal with the visor up during night or instrument conditions, if cockpit debris entered the eyes and excessive draft were present causing eye irritation and subsequent restriction of vision." ☆

A FLIGHT TO... ...FORGET!

"Honey, would you please put down that magazine and pay some attention to me?"

Silence.

An exasperated Mrs. C. Z. Chumley was beginning to reach the end of her rope. The day was hot, the children had been perfect demons, and her husband had breezed through the house like a cyclone hunting for a straw hat factory. He had slowed only long enough to grab a cold beer from the refrigerator, peck her dutifully but absently, and get reading material on his way to the hammock in the only shade in the back yard. Now, with something important on her mind, she couldn't get his long nose out of that book.

The mail had brought a letter from her parents in England. Again, longings to visit the land of her birth had been aroused. Several times plans had been made for her to make the long journey, but one thing after another—children, transfers, and once a new engine for her spouse's Jaguar—had prevented her going. Now her mother was making a special plea and Mrs. C. was determined to try her very best. Besides she was anxious to show off her progeny.

"Chauncey!" This time the tone of voice was ominous. The reclining figure in the hammock sat up and paid attention.

"Were you calling, dear?"

"Yes." Mrs Chumley pulled up a lawn chair and, using a most soothing tone, got into the task of selling the idea of a trip to the old country. C. Z. began to accept the idea that his wife was serious about the trip. Ideas began to generate.

"Tell you what, if we could get space available from McGuire we might be able to make it. Otherwise it's out because we simply can't afford it." He shook his head, thought about it a while, then had another idea.

"I've got it. I could join the base aero club. We could fly to McGuire, leave the airplane and fly it home when we get back to the States."

Four days later the Chumley family with two weeks' leave, a world of optimism and ironclad determination were airborne in a four-place light plane which the male spouse referred to only as a "bug smasher." The fact that he had broken Air Force regulations as well as base and aero club directives and SOPs mattered not a whit to Captain C. Z. Chumley. After all, he was finally at 5500 feet, eastbound.

Prior to takeoff on this Sunday morning the scene had been rather hectic. The Chumley family arrived at the aero club hangar with clothing, gifts, toys, a picnic basket, golf clubs (for St. Andrews, no less; after all why not play the best?), forty pounds of camera equipment and Mrs. Chumley's hat box. To say that the aircraft was over grossed would be a monumental understatement. As far as the weight was concerned, there was no problem. Chumley simply ignored that. There was a volume problem, however, that was only solved by the man of the family placing kids in the back seat, wife in the front, then stuffing the remaining items in around them. The hat box, of course, went on the "copilot's" lap.

Preflight amounted to undoing the tie-down ropes. The flight plan, which was on the brief FAA form, was filed with times rather vague, and the weather briefing was even more hurried than usual.

Fortunately, the base had 10,000 feet of runway, the sun had not yet heated the air above 80°F, and the elevation was only 670 feet. As it was, the little airplane barely managed to get off in 9850 feet, its 145 hp engine working furiously.

There was a brief moment of anxiety when Chumley could not get the aircraft to rotate—the stick seemed to be binding. Then the light dawned.

"Get that hat box out of the way—quick!" Mrs. Chumley reacted instantaneously and lifted the hat box, which permitted her husband to get the stick back.

Now at cruise altitude, the engine purring smoothly and the prospect of a glorious two week trip ahead of them, the Chumleys faced new problems.

"Daddy, I gotta go to the bafroom."

"And I'm thirsty."

Chumley knew from experience that he couldn't win, so he got out a map and found an airport five miles ahead. The landing reminded one onlooker of the Midway gooney birds setting down. The onlooker was even more astonished when the airplane disgorged the Chumley family and what was apparently four tons of various and sundry goods which had to be removed to get everyone out.

Chores completed, the reloading process repeated, Chumley taxied to the end of the 1500 foot strip. My, it looked short. Holding on the brakes and pushing the throttle to the firewall, C. Z. prepared to takeoff. Fortunately there was a dirt road alongside the strip. A zig at the end, then a zag onto the road gave them an unlimited runway that finally permitted the still overloaded plane to stagger into the air. Once again they were on their way.

Two hours later Mrs. Chumley pointed to a small instrument and asked her husband if it was important that what appeared to be a gas gage said empty.

"Empty, it couldn't be. We've only been flying for two hours." It was then that Chumley began to wonder about the weight they were carrying. Quick mental calculations convinced him that it really was a miracle that they were flying. No wonder those takeoffs had been so long. Perhaps the engine wasn't sluggish after all.

Back to the maps. Now, where were they? Paddlefoot Omni was behind them but how far behind them? Ah, there was an airport on the map, but was it ahead of them or behind them? Years of relying on the clocks had rid him of the habit of relying on visual check points. Now his training in pilotage began to come back. Finally, he picked out some hills that appeared to match those indicated on the map, and off in the distance there appeared to be a lake that squared with another map indication. Meanwhile he was frantically cranking the omni in an effort to get a radio fix.

Throttling back, he began a shallow descent. Time dragged. Mrs. Chumley didn't trust airplanes anyway and now she was convinced that next time they would take the train.

Finally, in the distance, the airport he had located on the map came into sight. Would they make it? A forced landing with this load, and his loved ones, could be disastrous. Chumley's hand was never lighter on the controls. He had on just enough power to keep the bird flying. They were getting closer. Then—sputter, cough, roar, sputter. They were on the fumes, all right. Then, that was all. The starved engine gave up.

"Cutting it pretty thin, weren't you?" observed the man with the pickup as he tied a rope around the nose gear to tow the airplane off the runway.

Chumley, for once, was speechless. That fence at the end of the runway had looked 20 feet tall. How the gear cleared it he would never know. But it had and the aircraft had settled in on the dirt and rolled onto the concrete for about 40 feet where it slowly shuddered to a stop.

The next 800 miles consisted of a series of two-hour flights punctuated by one-hour stops while the airplane was fueled, the family removed from the cabin, fueled and defueled, and replaced among the items of cargo. It was a hot, tiring, irritating trip. At nightfall McGuire was still some 200 miles ahead so the Chumleys called it a day. C. Z. was for continuing but his wife quickly vetoed that suggestion.

"We've had enough trouble in this sardine can in broad daylight," she said.

During the night a front had moved in from the gulf and thunderstorms were numerous along their planned route. The Chumleys continued, but on a winding, devious course among the thunderbumpers. There were times when they detoured as much as 25 miles. Once Chumley had tried to poke his way through a dark looking mess lying across their path. But the airplane didn't fly too well upside down, the kids cried, Mrs. C. complained about hanging on her belt and all the contents of the cabin—minus the strapped in passengers—came tumbling down, or up, depending on how you look at it, into their faces.

Then there had been that long period of terrifying silence when the

A Flight To Forget

continued

engine quit. It had been so long since Chumley had flown recips that he forgot some airplanes have carburetors. Fortunately, with carburetor heat and the lower altitude to which they descended away from the storm, the ice melted out and the engine coughed reluctantly to life.

As they traveled along one of the children, obviously mystified, asked, "Daddy, are we getting any place?"

"Whatta ya mean, getting anyplace? Sure we are," Chumley replied, slightly annoyed with what he construed as possible criticism of his conduct of the flight.

"Well, I wondered because you've been talking to the same man on the radio ever since we left home."

Puzzled, Chumley inquired as to what the child was talking about.

"That man, Uh Roger. You talked to him lots of times yesterday and again today."

Chumley started to explain, decided against it and advised the child that that was just the way things were and not to worry about it.

Finally they were over McGuire, at least the omni said so. Chumley couldn't see the ground because of the undercast.

"McGuire Tower, niner six two one Alpha, over the field at five thousand, landing instructions. And make it fast will you, friend, I'm a little low on petrol."

"Two one Alpha, are you Air Force and are you on an IFR flight plan?"

"McGuire, Two one Alpha. I'm Air Force aero club and negative on the flight plan."

"Two one Alpha, McGuire. Everything in the area is near minimums and we have no arrival for you. What is your destination?"

"McGuire, one Alpha. I—uh—am not on a flight plan. Destination is McGuire, please give landing instructions. And make it fast, this bug smasher is on the fumes now."

Airman Billingsley turned to his boss. "Sarge, there's some nut up there not on a flight plan says he wants to land here. Says he's an aero club type and he's about out of fuel."

"Ask him if the aircraft is instrument equipped, has he got an approach plate and is he instrument rated."

When asked these questions by the controller, Chumley replied quickly, "Affirm, negative, affirm, and please, let's get on with it. Ol' Alpha here is about to cough her last."

"One Alpha, are you declaring an emergency?"

"Uh, negative, just hurry up will ya?"

In the tower there was a hurried consultation; then, "One Alpha, switch to 134.1 for GCA. They'll get you down."

"McGuire, One Alpha, negative on the 134.1. I don't have that freq."

"Roger, One Alpha, go to 127.5."

"Listen, tower, I don't have all those freqs, this is a light plane."

"One Alpha, switch to emergency, 121.5. You must have THAT."

"Uh, Rog, tower. Radar, have you got me?"

"Two one Alpha, this is GCA, make a right turn to 190 degrees and descend to three thousand."

"GCA, one Alpha, turning right 190 and please hurry."

Moments later Chumley was instructed to turn right again to 270 and continue descent to 1500 feet. Finally, after another couple of turns, the welcome voice advised Chumley that he was now on final approach, five miles out and slightly high. At 200 feet and almost over the threshold Chumley had the runway in sight. There was another agonizing moment when the engine quit, followed by an embarrassed period during which a tug had to be dispatched to tow the aircraft off the runway.

What followed was not pleasant. Fortunately Mrs. Chumley and the children were spared from the scene in the operations officer's office.

The following seven days were glorious indeed. Luck was with them and within 24 hours of their arrival at McGuire the Chumleys were bound for England. There Mrs. Chumley's parents made much of the children, gifts were exchanged and all had a wonderful time. The only damp spot was the day Chumley motored to St. Andrews where rain fell by the bucketfuls all day long. Nevertheless, he would be able to brag at home that HE had played St. Andrews.

On their arrival back at McGuire, Mrs. Chumley demanded that her spouse obtain several large boxes and ship their huge load of paraphernalia home by express. Thus lightened, their trip in the "bug smasher" was less eventful than the eastbound flight had been. In fact, they made it home in one day.

Now, Captain, I have here eight pages of charges listing violations by the dozen of base and aero club directives, Air Force regulations and Federal Aviation regulations." said the base commander. "The FAA would be very interested—and grateful, I might add—if you would explain *in writing.*"

"But, sir, I was just flying that little ol' bug smasher. Now if I had been flying an Air Force plane, naturally I. . . ."

He was cut short. "Chumley, I want you to explain to me and to the FAA *in writing.* I know there's no real explanation, but I'm sure we'd all be entertained, if not amused, by what you have to say for yourself. But before you leave, I'd like to make a few things clear.

"No matter what kind of equipment you are flying there are rules to be observed. That 'bug smasher' as you call it can kill you just as dead as a Mach 2 jet. In fact, I wouldn't be caught in one of the things myself. Not only did you violate every rule in the book but you endangered your family as well as yourself. You also jeopardized an airplane in which the club has more than eight thousand dollars invested. You fouled up traffic so bad at McGuire that it took them two hours to get things back to normal. What if there had been an Air Force transport full of people that had to land because of an emergency?

"Now get this straight. As far as the aero club is concerned, you're through. As a matter of fact, if anything like this happens again I might shut down the club for good just to protect people like you from yourselves. Now get out of here and get writing. And Chumley . . ."

"Yessir."

"Quit bragging about playing St. Andrews. I tried that miserable place once and got rained out three days running." ☆

YOU AND "REX RILEY"

Lt Col Ben L. Holliday
815 Combat Support Group
Forbes Air Force Base, Ks

HAVE YOU EVER THOUGHT—as you near your destination—of advising of any code aboard and of your servicing or billeting requirements? It just might be that no one even knew you were coming, much less that you need transportation and quarters for 21 people! Inbound, get a clearance to the common Pilot to Dispatcher frequency *372.2*, as shown in the Enroute Supplement. Not all bases have this, but the list is growing.

For several years now I have been kicking around in the Air Force in administrative aircraft, landing at bases assigned to every Air Force command. For the past few years, I have been a SAC Base Operations Officer. In both capacities, especially the latter, I have become intimately familiar with the famous "Rex Riley" Award for outstanding transient services.

As of this writing, my home base is the proud possessor of this unique award. I say, "as of this writing," because this special recognition is not easily earned nor easily retained. Each base is continually reviewed by "Rex" and he has no qualms about taking away the award if a base does not continually measure up to the high standards required to merit his special recognition.

My purpose in writing this article is to point out certain things a pilot can do to assist a base in its service to him. In assisting the base, he automatically assists himself. For example, Section II of the FLIP lists a DV and servicing code for a pilot to use in completing his Form 175. This information, if passed by the operations dispatcher and the FAA Flight Service people, tells the destination base of any rank aboard, servicing and transportation requirements, passenger and cargo data, ad infinitum. The problem is, many pilots do not take advantage of this flight management tool. All too often, nothing is entered in the "Remarks" section of the clearance, yet valid servicing requirements exist for the destination base.

Then we have the situation where, because of unforecast headwinds or severe weather, a pilot will divert to a more suitable field. Upon his arrival, with 30 passengers needing billets, or with a Code 6 aboard, only the operations driver meets him because the mechanics of the system didn't work to advise the diversion base of his requirements.

Unfortunately, and much to our chagrin, we Base Operations people are not clairvoyant. If we were, about 98 per cent of these problems would not occur.

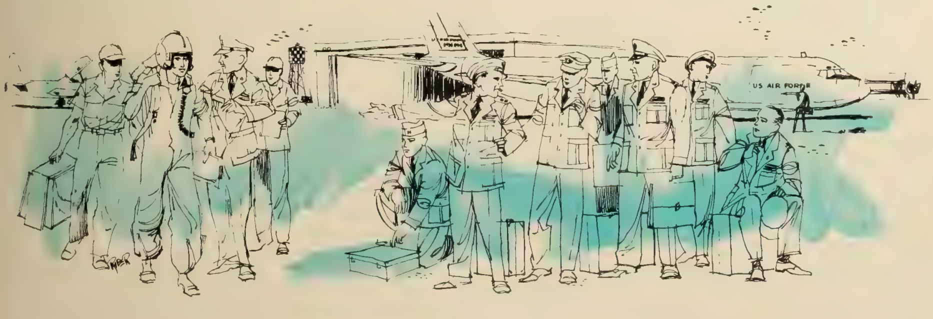
When you walk into the flight planning room to plan your delivery of 10 people and 2000 pounds to Podunk Air Force Base, check the FLIP for code entry appropriate for your mission. If you are discharging 10 of your passengers and 1000 pounds of your cargo at Podunk, then enter the appropriate code in the "Remarks" section of the Form 175. If you can take on five passengers at Podunk to your next destination, indicate this also.

You have now done one important part of your job as the pilot for that mission. Or have you? Can you be positively sure that your destination base will receive your transportation and servicing requirements? No, because Murphy's Law applies. There is a real good chance that during the relay of your flight plan, someone won't pass the word.

Now you normally have a workable radio aboard your aircraft. Use your Pilot-to-Dispatcher frequency to pass service requirements. So Base Operations has been told twice of your needs? Better twice than not at all!

Try this system sometime. I think that you will be happier for it. I know that we Base Operations types will be.

One final point: If you have *kudos* for a base, let Rex know about them. All too often, only the bad reports come to his attention while the good ones are accepted as a matter of routine. I am sure he wants to hear the good as well as the bad. ☆



Round Table on Guard

ED NOTE: Actually, it was an informal session — one of those things that gets started over a cup of coffee. This one centered on an old, perplexing problem: misuse of Guard Channel. Those involved were FAA, Facilities, a Project Officer and a safety education type. During the session the FAA representative suggested that publicizing comments made here might possibly aid in promoting more ideas. In the next issue an article, "For Want of Warning," tells how an F-101 aircraft was lost, by the margin of one blocked Guard transmission.

Editor: Gentlemen, to set the stage, three events have prompted this Round Table: One, a recent accident in which two pilots—not monitoring Guard during a GCA—failed to execute lost communications procedures, crashed into mountains and were killed. Two, neither the many articles that have appeared on unnecessary Guard transmissions nor any other actions have alleviated the problem. Three, we continue to receive many letters from pilots and safety officers citing the seriousness of this problem.

Project Officer: The accident mentioned was attributed to pilot error. Of course we can never know for sure, but the pilots were not monitoring Guard. A colonel, the safety officer of a major command, reported that the air was cluttered with unnecessary Guard chatter when he flew through the same area the day before. We suggest that the pilots killed in this accident, as I'm sure all of us here have, turned off Guard so they could hear the GCA controller.

FAA: What a miserable way to die—because you can't use the frequency set aside to save your neck.

Facilities: Who would you say are the worst offenders?

Editor: Controllers — Center, Approach, Departure, Tower Personnel . . . some pilots, but mostly, it's the ground controllers.

FAA: That may be true, but what causes the controllers to use Guard? It's usually because they can't contact the pilots on normal communications—maybe their radio has malfunctioned, or the pilots have turned down the volume so they can yak on the intercom, or they've gone to a tactical frequency without telling the controller, maybe they've tuned in the wrong frequency, and forgotten the previous frequency.

Editor: Now it's just a convenience frequency—not an emergency frequency. A controller can't get a pilot to answer, he picks up another mike, says "Air Force 12345, come up 327.4." It's too easy, maybe if we gave each one a pad and required him to jot down the time—who he called and why—make the use of Guard a nuisance.

FAA: Now, just a minute. When a controller uses Guard he has a reason to get contact with the guy. He may be at a conflicting altitude. He . . .

Project Officer: He should know that ahead, shouldn't he?

FAA: Not necessarily. There are many things the pilot, riding around listening to one discrete frequency, doesn't realize. Remember, the controller may be, and likely is

SUGGESTIONS WANTED

How about it, readers? Have you a solution to the Guard problem? Send your suggestions to the Editor, Aerospace Safety Magazine. We will pass them on to FAA and Facilities specialists.

working a lot more traffic on VHF than on your UHF. Then there's the "pop-ups"—the '101 that crashed a short time back was a "pop-up."

Editor: What's a "pop-up"?

FAA: He's a guy no one knows of ahead of time. He calls in—maybe he's been VFR, maybe he diverts—any number of reasons, but he calls and wants a radar vector or some other service to an airport. These guys have to be served too. All at once a controller can get snowed. He may have a real potential midair staring him in the face, and he's going to use Guard if he thinks he needs it.

Facilities: That brings up another point: Define an emergency.

Project Officer: Anything covered in the Red Bordered pages of the Dash One or anything else which, in the opinion of the pilot, constitutes an emergency.

FAA: Don't leave out the controller. He may have a few opinions of what constitutes an emergency from his end, too. Agreed, he might over anticipate the situation a little.

Project Officer: Okay. Another abuse is this "Ground Check on Guard." Maybe this has to be for towers and centers, but surely not for aircraft. If they get a good check on another frequency and a "click" when they switch to Guard, that ought to be good enough.

FAA: I don't know all about the military setup but when I worked in towers we had a dummy antenna. We could check Guard without blasting out over the air.

Facilities: I believe one procedure—at least it used to be, was for the radio mech to check with tower on another frequency, ask if it was okay to check on Guard. If Guard wasn't in use, Tower would say OK.

FAA: That's no good. Tower only knows what's going on in the local area. If I'm sitting up here in a T-Bird at 35,000, I can hear every Guard transmission in Southern California.

Project Officer: That's the thing. Besides, no one knows in advance when Guard may be needed for an emergency. This ground check may be just at that time.

Editor: Well, publishing articles hasn't provided the solution. Every safety publication I know of hammers away at this all of the time.

Facilities: I think first we'd better analyze the problem—define an emergency. Suppose I query AFCS, they have planes out monitoring, they get all transmissions on tape, maybe if we got with them, went over some of these tapes—that seems to me to be the first step.

FAA: Project Officer: Editor: Good idea.

Facilities: Okay, I'll write 'em.

Project Officer: We can check this "Ground Check on Guard" right here on the base.

FAA: Right, and I'll check this out with Center. I know we used to check it without transmitting on the air.

Editor: I still say we've got to get to the basic causes. And it's going to take drastic action, not preaching.

Facilities: May be, but we've got to have factual information first. I just came back from a trip, nearly 50 hours. I don't recall that misuse of Guard was very much of a problem.

Project Officer: What were you in?

Facilities: A Gooney Bird.

Project Officer: Yeah, get up around 40,000 and see the difference—how much IFR did you fly?

Facilities: Very little. Weather was good.

Project Officer: That's another thing. It's always worse in IFR, especially around congested terminals.

FAA: That's for sure—and there's always some joker around who has to be led; who can't tune his radio; who doesn't have the right maps . . . or doesn't know how to read them, and who thinks the controller has nothing else to do but wait on him.

Project Officer: And he thinks the radio is his own party line. This is another point that bugs me. You take a line pilot and some of the administrative types who have some professional pride—they use proper terminology, are brief, concise—it's obvious they know the score.

FAA: I'm glad you said it, but if controllers were as informal with their radio discipline as a lot of pilots the situation would be a lot worse.

Facilities: Well, I think we've all got the problem pretty well in mind. I think the first step is to query AFCS, then we'll get together again.

FAA: And I'll find out how we ground check Guard without transmitting on the air, and query the controllers on their opinions of what constitutes a necessity to use Guard. Our house might not be clean on this point, either.

Project Officer: Keep me posted. I still think something can be done. I'd like to go over the tapes.

Editor: And if anyone gets an idea as to how we can publish something that will make an impression, let me know. We've reported on the two guys killed over here on the side of a mountain. Even that hasn't seemed to have had any effect. ☆

Col James F. Risher, Jr
Chief, Ground Safety Division

As this is written, we in Aerospace Safety are basking in a warm glow of satisfaction in the knowledge that only three Air Force persons lost their lives in traffic accidents over the past Memorial Day weekend, whereas 13 lives were lost in the comparable period in 1963.

We are further gratified because for the first time in 1964, Air Force fatalities from motor vehicle accidents are on a downward trend as compared to the previous year.

There are other indications which make us hopeful that the amount of stress now being put upon accident prevention in this area is beginning to pay off. Nevertheless, should we need a reminder that the possibility for further progress against our number one ground accident source is almost unlimited, the following sampling from our files will be convincing. The writer requested a random (literally) sampling of reports of accidents which had occurred in the first few months of 1964. Following are brief resumes of eight reports which were picked from the files for review:

A RANDOM SAMPLE OF TRAGEDY

- A SSgt from a midwestern base departed his home at 0930 on a Saturday morning in his automobile, picked up a friend and spent much of the remainder of the morning at a local bar drinking beer (quite a few beers). After dropping his friend at his home, he entered a public highway at high speed and weaved and skidded for over half a mile on a straight road before his car finally overturned. The sergeant was thrown clear and instantly killed.

- Four airmen from a foreign base were traveling in the automobile of one of the airmen at excessive speed over a wet and winding highway in the rain. The driver attempted to pass a foreign automobile on a curve and collided with a civilian truck approaching from the opposite direction. All four were killed. Fortunately, the driver of the truck, though injured, survived. The airman had previous driver violations.

- An airman driving alone in a foreign country late at night at high speed rammed a native truck from the rear. His automobile was completely wrecked and the airman was killed. Again, fortunately, the driver of the truck, although injured, survived. There was strong evidence of excessive drinking as well as excessive speed associated with this accident.

- Six airmen from a base on the east coast were involved in an accident in which all six sustained major injuries but in which, miraculously, none was killed. They were on an outing in a private automobile and paused on their way to purchase one fifth vodka, one pint vodka, and one pint bourbon. These beverages, according to the report, were consumed during a two hour period at an outdoor theater. Subsequently, they made two bar stops. They then decided to visit yet another bar on the opposite side of the town. The accident occurred while their automobile was wandering around back streets in their search for this establishment. The automobile, moving at an excessive speed for city driving, struck a railroad embankment at the end of the street, traveled 45 feet through the air, and landed upside down on a six-foot embankment on the far side of the railroad. The automobile was demolished. The citation read in part "reckless driving and driving under the influence."

- An Air Force 2d Lt was driving his private automobile within speed limits under complete control, when a civilian vehicle abruptly entered the highway in front of him. Unable to stop or avoid the civilian automobile, the officer was killed.

- An airman was killed near one of our eastern bases when he fell off the rear bumper of his own automobile which was being driven by an airman friend. The victim and several friends had been celebrating at a bar and after a period of time had departed for a restaurant some 500 yards away. The airman fell in the path of an on-coming vehicle as the automobile on which he was riding made an abrupt turn on the highway.

- An Air Force lieutenant was killed while riding in the company of an airman, a fellow sports car enthusiast, in the latter's automobile. The investigation showed that the airman was driving too fast for conditions and lost control of his new car on a sharp curve on a secondary road. The driver was injured and the lieutenant was fatally crushed as the car overturned.

- An airman was killed while riding his friend's new motorcycle. The airman, who was a capable motorcyclist, was thrown from the vehicle when it collided with an automobile, driven by a civilian, which pulled suddenly in front of his motorcycle from a side road. The accident was not the fault of the airman, whose vehicle, was under proper control and moving within prescribed speed limits at the time.

A brief recapitulation reveals several facts from this limited sampling which fall into the well established pattern of Air Force traffic accidents. There were ten fatalities and an equal number of serious injuries in these eight accidents. That the fatality toll was no higher was largely a matter of chance. Of course, we should not forget that the use or absence of seat belts could have been a factor in some of these accidents. But the total of ten deaths, grim as it was, seems fortuitously low here, especially when we consider that some or all of the six airmen who were injured in one accident might well have been killed.

All Air Force persons involved were between the ages of 18 and 25, except the Staff Sergeant, who was 33. The highest enlisted rank was staff sergeant and all others were A3C through A1C; the highest officer rank was second lieutenant.

In those accidents involving collision between vehicles, the primary fault was shared equally between Air Force and civilian drivers. Two accidents clearly resulted from gross error of the civilian driver and two were caused by equally gross error of the Air Force driver. Contrary to the school of thought which coined the "Stop the GI Killer" slogan, this is the overall pattern of accident experience.

From the standpoint of Air Force traffic accident prevention, however, the cardinal fact is this: Of only two accidents may it be said that the Air Force victims could not have controlled completely the circumstances which cost their lives. The second lieutenant whose right-of-way was suddenly blocked by another vehicle while he was driving under proper control was such a victim; likewise, the airman motorcyclist whose path was also suddenly invaded by an automobile was such a victim. Even here it must be noted that had this airman been wearing a helmet, in accordance with a major air command directive, he may have been alive today. But *all* others who died, and all who were injured, in the other six accidents were clearly the victims of their own, or their Air Force companions' reckless, irresponsible, and foolhardy personal conduct and driving behavior. All were victims of conduct and attitudes on the highway which were completely incompatible with Air Force standards, and must certainly have been foreign to their behavior in the Air Force environment.

Corrections of these attitudes and these behavioral deviations on the part of our young men in the off-duty environment is a continuing challenge to all Air Force commanders and supervisors. We believe that progress is being made. But we know that we cannot rest in our efforts to make our young men more aware of their responsibilities to themselves, their families, the Air Force, and the nation. ☆

A LESSON LEARNED

Capt Carroll E. Hollier
354 TFW, Myrtle Beach AFB, S. C.

I guess it's time for this story to be told. It lay, a closely guarded secret, for years. However, recently I went the route of many fighter jocks. I became a Wing Weenie, specifically, Wing Flying Safety Officer. All of the schooling, instructions and work I have undergone since I took this job have convinced me that, although it may be human to err, not to profit from that error is catastrophic. In other words, every lesson learned should be preserved and passed on for the edification of others.

Picture, if you will, the average fledgling hot rock pilot (cocky, scarf, stupid). Yep! That was me. The locale of this story was a fighter training base in the Southwest. The bird was the F-100. We were sent there for the dual purpose of checking out in the aircraft, and, at the same time, to try to learn all of the tricks of the fighter trade (and believe me, they are many). You might even say we were kept busy, but we all enjoyed every minute of it. Besides, when you were down in the mouth, you could always smile and take solace in the fact that you were here and not flying an "aluminum overcast" like most of your old buddies from basic training. Fate was smiling at you and you were indestructible.

It was a normal desert day, clear, hot and beautiful. Man, I found a home out there! We had a six A.M. briefing for an eight-thirty takeoff. The briefing was conducted by the instructor and was very thorough. In fact, we had all commented on the thoroughness of all briefings since our arrival at the base. This instructor had the reputation of being an excellent pilot and for some time I had been eager to fly with him. Troops who had flown with him said that he was one of that rare breed of pilots who, besides having the ability to perform the job himself, was a master of the art of showing a student how to do it also. He had experience and experiences coming out his ears. He had flown combat in the Korean conflict and was half a MIG away from being an ace at the close of hostilities (said he looked and looked but never found a half a MIG flying around). He had about 3500 hours of flying time, all of it in fighter type aircraft. 2800 hours of this was in single engine jets including 1500 hours in the F-100. Impressed? I was!

The mission was to be air-to-ground gunnery. We would be a four ship formation. The flight line-up was given and I was number two. The instructor, naturally, would lead. Flight call sign was (I'll never forget it) SNUFFY. Start engine time was given and all gunnery patterns and procedures were cussed and discussed. As I said, nothing was left to chance. We even had time for a cup and a weed before going out to the aircraft.

My preflight was unhurried. I was strapped in at least 15 minutes prior to start engine time. After start the flight checked in on UHF, joined up in the marshalling area, taxied to the arm-dearm area and from there to number one for the active. From this point on the flight took on the semblance of the proverbial Chinese fire drill.

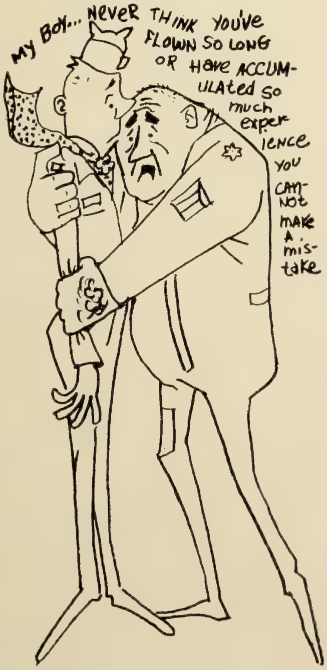
First we were told to hold for an emergency. It seems some nut in a T-Bird had a fear of flying just because his oil pressure was zero and his engine was making peculiar noises.

Very inconsiderate, he must have known we had a range time to meet. Well, no sweat. We'll just fly a little faster enroute. Ah! He's finally on the ground.

Then the tower called and said we'd still have to hold for another emergency. An F-100 was inbound with a utility hydraulic system failure, and, no, we couldn't expedite our takeoff before he arrived over the field. So we sat and waited and grumbled. Finally he landed safely. Still no soap though, 'cause he stopped straight ahead to wait for gear down locks to be installed. At this point we should have called off the whole shooting match, because we wouldn't get any range utilization anyway. It was past our range time, but we were spring loaded to the press-on position.

When the runway was finally clear, we taxied into position as rapidly as possible. A student landing period was almost upon us and on the ground those cockpits get kinda warm. Lead signaled for engine run-up, brake release and AB's. We rolled in two ship elements with 30 second spacing between elements. I concentrated on holding a good wing position. Just before reaching nosewheel lift-off speed, I noticed the lead was drifting to his right and into me. Well, the runway was pretty wide, so I followed suit and drifted too. He kept coming, though, and I was running out of lateral runway and ideas at the same time. It seemed like we had been rolling a couple of days and my nosegear was making a valiant attempt to come up through the floorboard. Quick like a bunny I snuck a looksee at the airspeed. Holy mackerel! 155 knots and we hadn't even rotated yet! I was in the world's fastest tricycle. I jerked the bird off the runway and passed directly over lead, missing him by less than I like to remember. He continued drifting toward the side of the runway I had just vacated.

As soon as I was clear of him lead broke ground and immediately went into about a 45 degree bank toward his right, the side I had been on. I aged about ten years. After about 30 degrees of turn lead righted his aircraft and went into a slight climb. I called and told him his gear was still down. He rogered my transmission and promptly rolled over to a near inverted position. Everyone began hollering at him over the radio. Then, suddenly, the aircraft righted itself and the instructor called that he had everything under control and to start trying to make this fiasco look like a formation. Needless to say, we didn't fly too tight for a few minutes.


MY BOY... NEVER THINK YOU'VE FLOWN SO LONG OR HAVE ACCUMULATED SO MUCH EXPERIENCE YOU CANNOT MAKE A MISTAKE

Aside from a few gray hairs and the fact that we were too late for our range period, the balance of the mission proceeded uneventfully. So after flying around the flagpole for about 45 minutes, SNUFFY flight landed, a much shaken group of young men, especially me. The instructor met me at my aircraft and hustled me into a briefing cubicle in operations. I believe if he could have found a SECRET sign he would have hung it on the door. He first apologized and then gave me the straight skinny. His explanation was preceded with this sound advice: "Never think you've flown so long and have accumulated so much experience that you cannot make a mistake." How many times have I had occasion to remember that!

While the flight was delayed so long at the end of the runway he had decided that he would make a few additional (typical fighter jock) checks. He had, among other things, run his aircraft trim full nose down, full right aileron and full right rudder. Suddenly, we were cleared to line up and takeoff, and, in his haste to expedite, he FORGOT TO RETRIM THE AIRCRAFT. His right rudder trim accounted for his drift on the runway. His nose down trim made it very difficult to raise the nose causing the excessively long takeoff roll. The right aileron trim caused the bank right after takeoff. When I called him about his gear, he was standing on his left rudder while holding the stick somewhere in the lower left side of the cockpit and having to use two hands to do it. He let go with one hand to raise his gear and couldn't hold his altitude. Evidently he thought better upside down, because, while he was inverted, the cause of his little problem hit him right between the eyes. He retrimmed and that was it.

We both decided not to spread the story around and get the Head Shed troops all excited. But I'm sure he will understand my stated reason for reneging. So I'm getting this off my chest in hopes that somewhere, someone will slow down a couple of beats and follow that checklist. It covers everything in the cockpit. However, I'm sure you'll excuse me if I push the TRIM FOR TAKE-OFF BUTTON a few more times than the good book calls for. ☆

You're Wanted ...Safely Home

SMSgt Edward J. Matus
NCOIC, Flight/Nuclear Safety Div
WRAMA, Robins Air Force Base, Ga

Here's a pitch on behalf of the next of kin. Look at the pictures on this page. They show personal equipment of Air Force crewmembers. Carelessness, such as this, can be deadly.

Hypoxia — when allowed to happen through equipment upkeep errors — is without excuse. Unforgivable! Pointedly so. Because the sequence of events that leads to the destructive end of life and property is man made. Why man made? Because the events are controlled by man. Man allows them to happen, primarily, due to his own attitude — his attitude toward uipment that permits him to live in

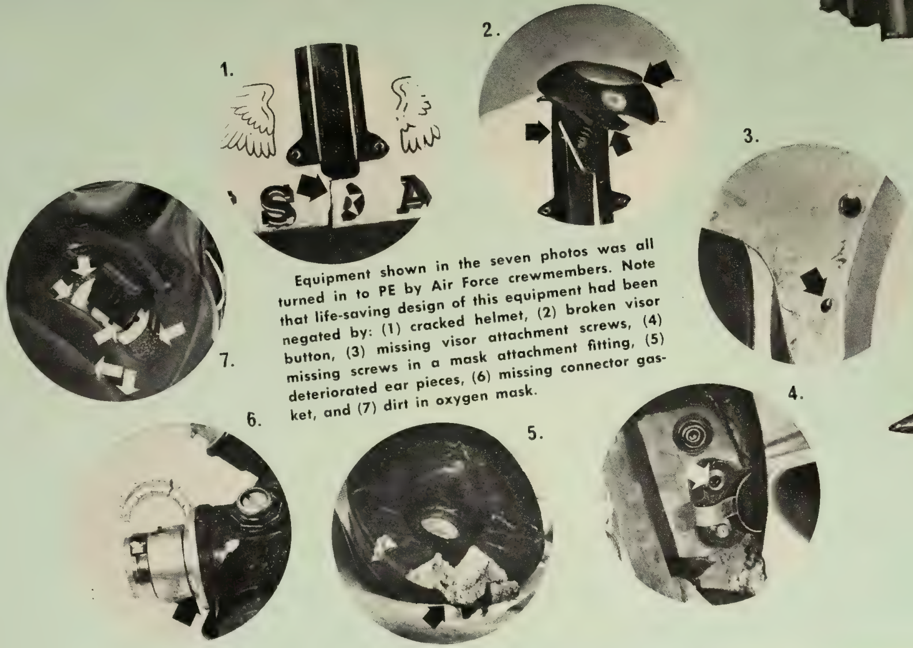
can be careless with their own life protection equipment.

What sort of thinking should we apply to this recurring "careless" attitude toward personal equipment care? What will cause an individual to take the time to personally concern himself with the condition of his life-sustaining equipment and then, as prescribed or as needed, do something about it?

If you believe you do not have the time to get your helmet repaired or your oxygen mask cleaned, then you probably also believe that "accidents" always happen to the other guy. shows that it's people possesses is self-preser would influence his at- "to stay alive," in itself, would influence his attitude and be a strong enough motive to maintain at least a semiconscious level of thought that would induce him to care for his lifesaving aids.

The photographs of the helmet and oxygen mask shown here show, irrefutably, that men

sonal equipment is preventable. quires virtually no effort on the part of the aircrew member. Simply bring it in to PE for inspection, cleaning and repair or replacement as necessary. It costs you nothing, and can save a life — yours! ☆



Equipment shown in the seven photos was all turned in to PE by Air Force crewmembers. Note that life-saving design of this equipment had been negated by: (1) cracked helmet, (2) broken visor button, (3) missing visor attachment screws, (4) missing screws in a mask attachment fitting, (5) deteriorated ear pieces, (6) missing connector gasket, and (7) dirt in oxygen mask.

Lt Col Harold K. Boutwell, Directorate of Aerospace Safety

MY mother-in-law doesn't know anymore about flying than a bedbug, but she knows one thing: mountainous terrain can be dangerous. In fact, she won't fly to the West Coast, although she has flown all over the East and South.

Sounds silly, perhaps, but maybe some of us who are paid to know the flying business would do well to pay a little attention to what that sweet old gal says.

Naturally her fears are based on newspaper accounts of aircraft flying into the hills. It doesn't take a Rhodes scholar to add up these accounts and come out with the answer that there may be additional risks in the mountains.

I hope you are still around because I want to relate an incident. It's based on fact and it happened this year.

An IP was administering an instrument flight check on a cross-country. On arrival he filed the following Operational Hazard Report:

"We requested an Edgar 3 departure from Tall Timber AFB on our DD175 and filed for 11,000 feet to Pouch and then V-307 to Queenly Field. Ground control cleared us at 11,000 to Queenly Field via direct Pouch and then V-307 to Queenly. We requested from Departure Control to fly the Edgar 3 departure as I was giving an instrument check. Tall Timber Departure said they would be unable to grant us the Edgar 3 departure because of conflicting traffic. They gave us instead a vector direct to Pouch. However, they did not alter our assigned altitude of 11,000. The direct route to Pouch from Tall Timber took us directly over Mt Eve which is 12,307 feet high.

"Tall Timber departure control got us well on our way on the vector to Pouch and then handed us off to Seaside Center. We checked in with our altitude and our estimate for Pouch which Seaside Center acknowledged.

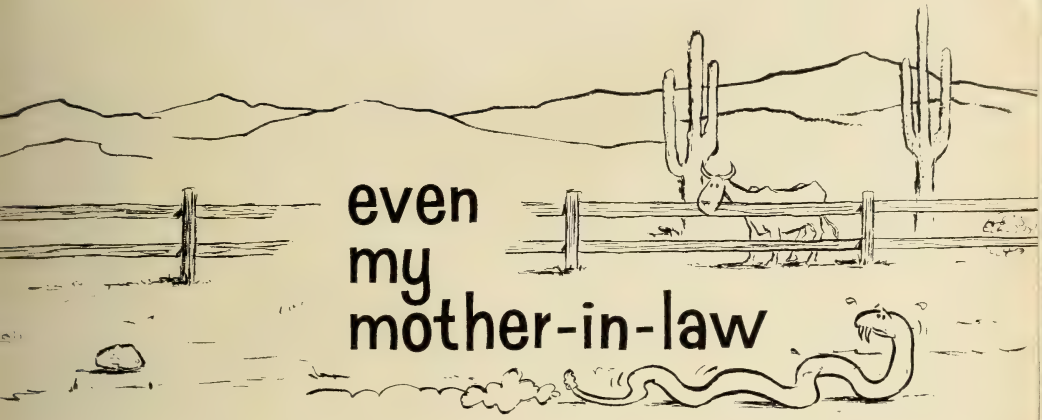
"After about five minutes the FAA controller at Seaside Center said we had Mt Eve 12 o'clock at 15 miles and said also that we were outside of controlled airspace so that he could not give us vectors or altitude changes to clear us from the mountain. We requested and received an altitude of 15,000 feet to clear the mountain.

"A definite operational hazard exists when departure control gives an aircraft a vector into uncontrolled airspace at an altitude that is below the terrain along the flight path. If departure control wanted to send us direct to Pouch they should have checked the terrain along our proposed flight path and assigned us an altitude that would clear all terrain."

There is something about a "close one" that really triggers action. The first thing we want to know is—what happened? How does one get jockeyed into this position and how can we prevent its recurrence.

To begin with let's congratulate the FAA controller. But for his timely action we may have lost a crew and an aircraft. Well Done!

An investigation was conducted to determine all the facts surrounding this near mishap. But before we get too involved with the facts here are a couple of quotes that should be kept in mind. "Before beginning a flight, the pilot in command of the aircraft will familarize himself with all available information appropriate to the intended operation." And, "When outside of control areas and over designated mountainous ter-



even my mother-in-law

rain, an aircraft will not be flown less than 2000 feet above the highest terrain or obstacle within 25 miles of intended line of flight."

Here is the sequence of events that must be added to the OHR.

The pilot planned his flight as stated in the OHR. He asked for 11,000 feet. Had he been cleared in accordance with his flight plan he would have attempted to cross a 14,000-foot mountain (out of controlled air space) at 11,000 feet. But that's getting ahead of the story. RAPCON advised Tall Timber Tower that, when Air Force 99999 requested a clearance, to advise him that 11,000 was too low for the route that he requested. When Air Force 99999 began to taxi, the pilot advised the tower that he now wanted 11,000 to White Sox and 13,000 to Calamity Falls. (NOTE: This change did insure minimum enroute altitude clearance for that portion of the flight conducted in controlled air space.)

The clearance was issued to the Calamity Falls VOR via direct Pouch, flight plan route, maintain 11,000 while in controlled airspace. The RAPCON was unable to approve the Edgar 3 departure because of other traffic. Examination of the direct route to Pouch, or the route from the end of the SID direct to Pouch, indicates that at 11,000 feet, neither meets required terrain clearance.

Two minutes after Seaside Center had obtained radio and radar contact with AF 99999 they asked him if he was VFR and if he had Mt Eve in sight. The pilot replied negative; he was IFR at 11,000. The controller therefore advised the pilot that Mt Eve was at his 12 o'clock position at 15 miles at 12,200. The controller asked the pilot if he wanted a higher altitude or whether the pilot requested a vector around the mountain. The center controller explained that he could not vector an aircraft outside of controlled airspace unless requested by the pilot.

Two minutes later the pilot requested a higher altitude and was cleared to climb and maintain 14,000 feet while in controlled airspace.

There are the facts.

Who did what to whom?

The experts in air traffic control made the following statement. "We consider the handling of this aircraft by the Tall Timber RAPCON and the Seaside Center to be normal."

Now let's review the pilot's actions.

Although there were mitigating circumstances in that the flight route was changed, let me point out that the route flown was actually within five miles of the route filed.

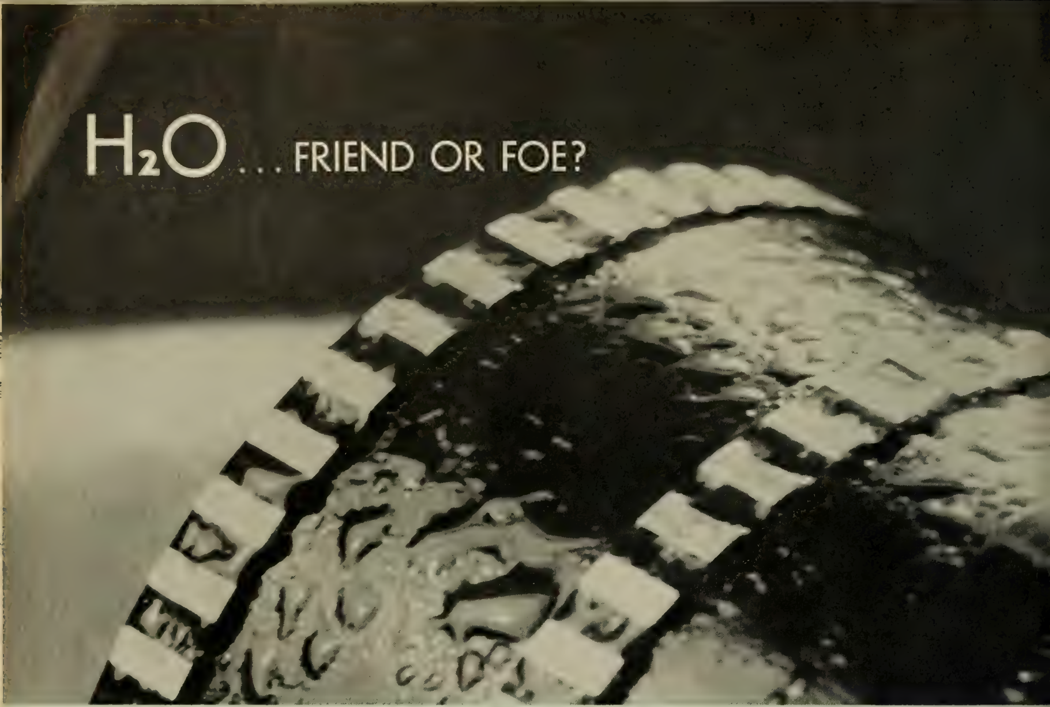
Slowly but surely we have arrived at the crux of the matter; i.e., proper flight planning. These pilots failed to refer to a map showing the topography of the flight route area.

It is quite understandable how the change in flight plan could have misled the pilot into thinking that ATC had done him an injustice; however, had he referred to a map and not the FLIP Enroute Chart alone he would have realized immediately that his proposed flight would have required a "mountain penetration capability" type aircraft.

Another point that should be stressed was that his clearance altitude pertained to controlled areas only. Moral: Do not use the FLIP Enroute Charts for planning flights in uncontrolled airspace.

As my mother-in-law says, "flying around in mountainous terrain can be dangerous." ☆

H_2O . . . FRIEND OR FOE?



Willie Hammer, Directorate of Aerospace Safety

Moisture is one of the essentials of life, but its presence may constitute a hazard, causing mishaps and malfunctions. The major problems result from condensation of atmospheric moisture.

Everyone is familiar with the phenomenon of moisture condensing out of the atmosphere, usually at night, onto cold objects such as blades of grass, leaves, rocks and metal objects.

Similar occurrences take place when the moist atmosphere inside a missile silo hits the metal of a cold refrigerant line, a tank cooled to a cryogenic temperature, or a cool piece of metal equipment. In some instances, enough moisture may condense on equipment to form a continuous stream of water, even when the ambient temperature is far above the dew point.

The worst effect of condensation of moisture on metal surfaces is the action of water as an electrolyte in the promotion of corrosion. The commonest forms of corrosion are electrolytic in nature between two dissimilar metals or different components of the same metal. For corrosion to occur there must be a conductor between two metals, and a liquid electrolyte to carry dissolved metal ions in solution. In general, corrosion due to condensation of moisture is negligible when the relative humidity is less than 30 per cent.

Corrosion has numerous adverse results.

- Structural strength of metal may deteriorate to such an extent that parts or fasteners may fail.
- Corrosion products may build up to such an extent that parts which should move freely will bind and be rendered immovable. A frequently seen example is that of rusting nuts and bolts which must be disassembled. In a case involving Atlas F, a critical solenoid could not be activated because parts were rusted.
- Corrosion products may cause jamming of valves, orifices or other flow passages, resulting in operational failures.
- Pinholes caused by corrosion may permit leakage of toxic or flammable liquid propellants.
- Surfaces may be roughened and disfigured, ruining the appearance of the item.

Water condensed or deposited inside electrical conduit, equipment or connectors may cause short circuiting. Moisture in these places may also induce corrosion which may cause short circuiting. This may occur if the equipment is not shielded against the entrance of very humid air, rain, snow or washdown water. At night, relative humidities in many areas are frequently over 90 per cent. Metal need be only slightly cooler to cause condensation of moisture.

Examples of malfunctions which have occurred from these causes are:

- A Titan I pressure switch failed because of corrosion caused by moisture condensed after extreme temperature changes. This resulted in a false hydraulic pressure indication and loss of missile alert status.

- Moisture in an electrical connector permitted a short circuit which discharged the power and servo batteries in a BOMARC missile, and ignited the ramjet engine flares. Contamination was present in the connector. Dry, it was a poor conductor; wet, it became a conductor good enough to permit the short circuit.

- Communications equipment, jack stations and terminals of maintenance telephone nets in Titan I complexes malfunctioned because of corrosion caused by moisture introduced by high pressure water washdowns.

- Moisture condensed from humid air collected in AGM 28 connectors causing short circuiting of the electrical system and malfunction of the missile.

High humidity may cause overloading of air cooling systems. To cool air it is frequently necessary to dehumidify it. The warm, humid air is passed over cold coils which reduces its temperature below the dew point desired. Excess moisture condenses and is removed.

The refrigeration necessary to condense a pound of moisture is much greater than that required to cool a mixture of air and moisture to a specific temperature. (To cool one pound of air-vapor mixture one degree Fahrenheit requires removal of about one-quarter of a BTU of heat. To condense one pound of water from gas to liquid necessitates removal of over a thousand BTU's.)

Moisture may enter equipment and piping in cryogenic or high pressure systems opened for maintenance and repair. This moisture may later cause malfunctions of the system by freezing and blocking orifices and valves. In cryogenic systems, the extremely low temperature of the cryogenic fluid may freeze the moisture and plug passages with the resultant ice. In high pressure systems, expansion of a gas through a valve will create a drop in temperature which will also cause freezing. The most familiar example of this is in the freezing of carburetors of aircraft. Another is in the formation of vapor trails by high speed, high altitude planes.

External freezing may also cause jamming of movable parts by layers of ice. This may occur when a missile kept in a warm, humid shelter is suddenly exposed to frigid outside temperatures. In another case, atmospheric moisture was condensed in a Titan I disconnect by cold helium vapors (about —200°F). During the next exercise, the moisture froze again, preventing the disconnect arm from falling away properly and causing it to hit the silo crib structure as the missile was raised on its elevator.

Moisture may have other adverse effects on materials and equipment:

- Some solid propellant motors are hygroscopic (absorb moisture from air). Moisture may cause leaching of ammonium nitrate or ammonium perchlorate from motor grains by which the ammonium compound is washed out of the propellant mixture. It is then deposited on the surface of the grain making it oxidizer rich. After ignition burning will take place at an abnormal rate, creating excessive pressures which may burst the motor case.

- Some propellants are harmless when dry but will form corrosive compounds with moisture. An example is nitrogen tetroxide, which when wet will form extremely corrosive nitric acid. Acid formed this way damaged a Titan II computer by pitting electrical connectors and gold plated surfaces.

- Moisture may cause swelling or change the properties of non-metallic materials. Humidity will so affect the plastic radome of the BOMARC missile that severe variations in energy transmissions through the material will occur.

- Moisture condensed in fuel tanks may dilute the fuel, or otherwise cause erratic engine operation. Moisture in oil may destroy its chemical characteristics and lubricating properties.

- Optical devices, such as television lenses, goggles and facepieces, may fog in the presence of moisture, reducing their effectiveness or preventing further operations.

- Thermal insulation will lose its insulating value when even partially saturated with moisture. In many cases, the insulation itself may be ruined beyond rehabilitation.

(Above) Friend? No doubt about it. Ever try to water ski without a good supply of H_2O? (Opposite page) Foe? The worst effect of condensation of moisture on metal surfaces is when water acts as an electrolyte and promotes corrosion. Structural strength of metal deteriorates and parts or fasteners may fail.

High humidity may also cause psychological and physiological stresses in people. Tests have shown that persons working in atmospheres of high temperature and humidity become irritable and fatigued more easily, have less ability to concentrate and make numerous errors. The length of time protective clothing which is impermeable to moisture can be worn decreases as the humidity builds up inside the clothing. Provision must therefore be made to minimize the presence of moisture inside such equipment.

Tests have shown that in temperatures of 70 degrees to 80 degrees Fahrenheit people may be comfortable even when the humidity is as high as 70 per cent. (The exact amount will vary with the person, the clothing worn, the activity and the wind velocity.) At a temperature of 80 degrees and humidity of 90 per cent or more, a person may begin to feel uncomfortable. At 92 degrees Fahrenheit or higher and with humidity of 90 per cent or more, there may be increases in body temperature, pulse and rate of breathing, and heat exhaustion. The increase in body temperature is due to the fact that evaporation and heat loss from the skin are inadequate to dissipate the heat produced by the body. High relative humidity means that there will not be much evaporation

H_2O . . . FRIEND OR FOE?

continued

because there is already considerable moisture present.

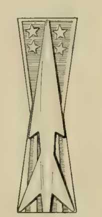
Problems may also be created by *low* humidity. Generation of static electricity is one of the principal ones which affect missile system operations. Low humidity is conducive to the accumulation of electrical charges and to severe discharges. Tests showed that personnel entering a warm, dry room from Arctic cold and removing a parka or wool shirt might carry 3.9 millijoules of electrostatic energy at 8000 volts. This is far above the energy requirement to ignite a gas-air mixture (about 0.03 millijoules for hydrogen and 0.5 for methane in air).

Low humidity will also cause drying out of organic materials such as cotton, plastics, wood and leather. This may result in shrinkage and cracking of wood items and of sealants. The mucous membrane of persons in low humidity spaces will dry out, leaving them susceptible to respiratory infections caused by bacteria normally picked up by these surfaces.

Proper humidity and moisture may be maintained in a number of ways:

- Use vapor barriers to prevent moist air from reaching corrodible or moisture sensitive materials.
- Eliminate introduction of water by seepage, rain, indiscriminate washdowns or by air wash systems.
- Install and use dehumidifiers and drying equipment.
- Package corrodible spare parts in moistureproof containers. Do not open moistureproofed packages until necessary to do so.
- Use anti-corrosion coatings, paints or noncorroding materials to protect or reduce deterioration of metals.
- Avoid damage to coatings and paints which might destroy their protective films.
- Replace dessicants when they near saturation.
- Provide adequate drain holes at locations where moisture might accumulate.
- Keep air conditioned spaces at the temperatures and humidities specified.
- Purge and dry critical components as required by technical orders.
- Keep rocket motor nozzle and solid propellant gas generator closures in place.
- Avoid leaving hygroscopic materials on corrodible metal surfaces.
- Keep the doors and windows closed between air conditioned and unconditioned spaces.
- Insulate cold surfaces on which moisture might condense. Where insulation is not feasible, use drip pans and drains to remove the moisture.
- Potting compounds and sealants should be used where required, and replaced as necessary to keep out moisture and humid air. ☆

MISSILANEA



TOO MANY COOKS. Here's an accident that once again emphasizes the veracity of that old saying about too many cooks spoiling the broth.

A specialist trouble-shooting the armament system of an F-102 was working on the launcher rails in the aft bay. He had assured himself that all selector valves were disconnected prior to trouble-shooting the system. After locating a bad wire in the aft selector cannon plug he reconnected the forward valve. Then he left the aircraft for a few minutes. While he was gone the missile safety officer and loading crew chief, investigating an incident, inspected the aft selector valve and apparently left it partially connected.

You guessed it. The specialist returned to the aircraft, stuck his head into the lion's mouth and hollered for someone to pull the trigger. Sure enough, someone obliged him; the rails retracted and the man received a broken vertebra.

This accident was caused by uncoordinated maintenance and incident investigation being conducted simultaneously.

MACE (CGM-13B) HOIST FAILURE—A missile replacement team was attempting to de-mate the M16E3 rocket motor from a Mace missile. The right pivot jaw on the 14-C bomb hoist failed as the screwjack was being retracted and weight of the rocket motor was being shifted from the missile to the hoist. The motor fell about 20 inches to the transporter and the left bomb hoist cable pulled out of the adapter hoist cable lug. Damage included one broken pivot jaw point and a cable pulled loose from the attachment lug. The rocket motor was declared unserviceable.

Investigation revealed that:

- The bomb hoist had been weight tested the previous month.
- The annual cable inspection had been accomplished approximately three months before the mishap.
- The pivot jaw assembly had been magnafluxed about three months before the mishap.

Primary cause factor was determined to be materiel failure. An EUR was submitted recommending that the sheer strength of the pivot jaw be increased 10-25 per cent, also possible redesign of the threaded portion to increase the strength at the critical bearing joint.

Lt Col John A. Worhach
Directorate of Aerospace Safety

FAA ADVISORIES

Robert L. Terneuzen
FAA Liaison Officer
Directorate of
Aerospace Safety

RECORDED APPROACH CONTROL INFORMATION — To relieve congestion on approach control frequencies, the FAA is conducting a test evaluation, whereby recorded airport info (landing runway, wind, altimeter setting, etc.) is automatically broadcast on some selected VORs and VORTACs. Pilots using this feature should, on initial contact with approach control, repeat the phonetic alphabet code word appended to the recorded broadcast. This will indicate that he has received the lastest information.

The use of this feature is not mandatory but pilots are urged to participate.

Tests are being conducted on the following NAVAIDS:

- John F. Kennedy Intl. VORTAC, IDL 115.9 mc. The scheduled weather broadcast service and air/ground communications by the New York Flight Service Station on the Idlewild VORTAC will be suspended for the duration of the test; however, it will be available on the Deer Park VOR, Roverhead VORTAC, Hampton VORTAC, plus assigned VHF/UHF communications frequencies.
- O'Hare Intl. VOR, ORD 111.6 mc.
- San Francisco Intl. VOR, SFO 111.8 mc.

☆

WHAT'S NEW IN WEATHER REPORTING. The FAA is vitally interested in providing its air traffic controllers with the most modern radar equipment, especially a system that will improve their capability to observe severe weather conditions.

In November 1963, the Bureau of the Budget directed the establishment of a high level committee to work on the coordination of federal meteorological services. This committee is composed of representatives of the Department of Commerce, Army, Navy, Air Force, Agriculture, Interior, State, Treasury, the National Aeronautics and Space Administration and the Federal Aviation Agency. Chairman is Dr. Robert M. White of the U.S. Weather Bureau. They and their committee on basic aviation meteorological services are actively working on methods to improve receipt of and dissemination of severe weather advisories.

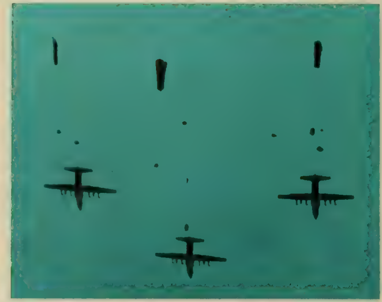
The FAA is vigorously attacking the problem of supplying improved weather data to both the controller and the pilot. The installation of circular polarization on FAA air traffic control radars some years ago improved the capability to maintain continuous tracking of aircraft through heavy precipitation; however, circular polarization eliminated much of the weather appearing on the display.

At 19 selected FAA terminal facilities, Weather Bureau radar data are being remoted to the IFR room to assist the controller in determining areas of severe weather not generally seen on airport surveillance systems because of circular polarization. The Weather Bureau radar displays will not be used directly to vector aircraft around severe weather echoes but will be used to provide the controller with information concerning weather location so that he can vector the aircraft around the adverse weather using the air traffic control radar.

The FAA is presently evaluating the use of AVQ-10 airborne radar systems in the Denver Tower and the Chicago Center. This evaluation is in the early stages insofar as their usefulness in air traffic control is concerned. But there is hope that the AVQ-10 will prove to be of value to controllers in providing improved weather information to pilots at a minimum cost at some of the less busy locations.

In the late fall of this year, the FAA expects to have installed in the Washington Center a modification of the existing radar systems which will permit the display of precipitation areas on the controller's operational display. This will be done through the use of the iso-amplitude contour lines showing the intensity of the precipitation in the area. Hopefully, this will permit controllers to vector aircraft around severe weather areas without reference to anything but their own operational display. Concurrently with this evaluation a technique of superimposing weather data received from the Weather Bureau radar onto the controller's radar operational display will also be evaluated. This technique uses a polar videcon camera to continuously photograph a Weather Bureau display and remote this data to the FAA ATC facility.

As soon as these various techniques can be evaluated, it is planned to install the best of them in ATC facilities as rapidly as resources permit.



FOUR STAR PERFORMANCE

Lt Col Paul L. Smith, 839 Air Div., Sewart AFB, Tenn.

★ THE 314TH TROOP CARRIER WING, Sewart Air Force Base, Tennessee, earlier this year won its fourth successive USAF Flight Safety Plaque. No other unit had ever received more than three in a row. The 314th had over 125,000 accident-free hours at the time of the award.

What's so special about the 314th record? I'm sure a lot of fighter jocks don't think so much of a four-engine transport outfit racking up a mark like this. Well, the 314th is not just a transport wing. It is an assault unit that does things that make safety officers' hair stand on end. For instance?

Well, how about taking our big bird out to a little 80-foot wide, 2500-foot long army dirt strip in the boondocks. Just to make it interesting, let's load a 15,000-pound bulldozer on board and fuel up so we weigh about 120,000 pounds. Now, let's get real dirty and put some 60-foot trees on one end and some power lines on the other. Give up? Not the 314th. They don't like situations like that and they don't do it on a daily basis. Point is, they have done it. And they continue to take that big aluminum overcast in and out of sod and dirt airpatches constantly, delivering men and equipment, weighing as much as 25,000 pounds per load.

If you think stopping a 50-ton aircraft in 2000 feet is strictly on the safe side, you must come take a ride with us some day. Takeoffs often involve clearing a fifty-foot group of trees off the end which requires a bunch of power. Loss of an engine under these conditions gets to be a mighty interesting proposition.

What else? How about setting up a cable stretched four inches off the ground and bringing our big bird down with the aft cargo door open, ramp at the trail position, and catching that cable with a hook which yanks a load out of the cargo compartment. Now, let's foul this up a bit by making that a 15,000-pound cargo. Let's also locate that cable out in a soy bean field where the approach and departure are over trees. No landing field and darn little level ground. It's called ground proximity extraction and that's just where you get—in close proximity to the ground—at 120 knots. Hardly a routine transport operation, but the crews do it daily.

An innovation of this technique involves coming down over an area without hooking a cable. Instead, they just release a chute which then yanks the load out. They've done this one at 15 feet over a snow and ice covered field where a landing could have been disastrous.

Of course we have the new CLOSE LOOK formation procedures. You fly five second in-trail formation at 250 knots down at 300 feet. At the DZ you pop-up to drop altitude and slow down for the troopers to exit. Then back on the deck for escape. Sounds like a fighter bomber action, doesn't it?

All this is meant to show that this isn't a bunch of slow Joe point-to-point airline pilots. Point to point! A crew in this outfit may be in South America this month, Europe the next, and in Asia later on. They average about six months a year on the road and about half of the rest of the time they're dropping troops and equipment for the Army at Pope and Campbell. A well adjusted wife is almost a necessity.

The record they have established is no accident, if you'll forgive an old pun. It goes back to Colonel W. H. DeLacey, now in Portugal, followed by Colonel William Moore, now the 839th Air Division Commander, and currently under the command of Colonel Arthur C. Rush. These men recognized that Safety is a command function and they emphasized it. When your staff knows you're behind the safety program, they get behind it too. When an outfit flies to all parts of the world, is recognized as the leader in assault airlift, and is chosen as the innovator of such items as the extraction systems, the CLOSE LOOK procedures and the assault landings on sod and dirt areas, they have to be good. The 314th is. ☆

PROS ON THE HOSE

The F-106 hit, burst into flames, skidded, and bounced to resting place. Dark areas show fire damage. Pilot was rescued by men in photo below, who stopped fire from spreading and completely destroying aircraft.

Tony Rotondo Crew Chief	**Fred J. Sprouffske** Asst. Fire Chief	**Fred Fletcher** Deputy Fire Chief	**SMSgt James F. Terrell** NCOIC McChord Fire Dept	**TSgt Curtis L. Dunn** NCOIC "A" Shift

It was the second flight of the day for the aircraft, an F-106 assigned to McChord AFB, Wash. The fighter was only 10 hours out of IRAN. The flight was uneventful until moments before touchdown. The subsequent events left the pilot thankful that a team of real pros was standing by to handle just such dangerous emergencies as he was about to experience.

During flare, with the main gear tires only inches off the pavement, the aircraft began to roll to the left, the nose began to rotate upwards and the aircraft veered off the left of the runway. Opposite the 2200-foot point the left wingtip hit the runway shoulder. It continued to drag the ground intermittently until the left main gear touched down.

Now, with the tires on the ground, the aircraft was in a wings level, nose high attitude. It continued this way for a moment then became airborne again until the gear and aft section struck a mound of earth. Now the gear failed and the aft section broke into flames.

As the aircraft started breaking up the nose section broke off causing the canopy to jam closed. When the fighter stopped sliding the pilot, trapped in the cockpit, began to hack away at the canopy with his canopy breaking tool.

Help was quick to arrive. As the '106 was approaching the runway on final, the base fire department was just winding up an emergency involving a C-124 that had landed with engine trouble. Deputy Fire Chief Fred Fletcher was following the transport to the ramp when the F-106 accident occurred.

Immediately Fletcher started for the burning fighter, while alerting the fire crash net via radio. He arrived at the scene just after the aircraft stopped sliding. Despite the fire spreading through the aft section and the wings, Fletcher was able to approach the cockpit and attempt to open the canopy. Due to the stress on the fuselage, the canopy had jammed and could not be opened. Fletcher managed to break a small hole in the canopy and assure the pilot that crash firefighting equipment was on the way and would be there in seconds.

Moments later the crash rescue crew, consisting of Assistant Chief Fred J. Sprouffske, SMSgt James F. Terrell, NCOIC of the Fire Department, TSgt Curtis L. Dunn, NCOIC "A" shift, and Crew Chief Tony Rotondo, arrived and broke out the right canopy glass with a sledgehammer. They pulled the pilot free. A doctor had arrived and the pilot was delivered to him, uninjured.

Meanwhile firemen had stopped the spread of the flames which had enveloped the tail section, most of the left wing and forward to the engine intake on the right side.

This prompt action by the McChord firemen typifies the courage of USAF firefighters. When a life is at stake promptness and knowhow are essential. These are acquired to a great extent through training—monotonous, tedious, even hazardous, but necessary training. And, when the chips are down, TRAINING PAYS OFF. ☆

BAD BRAKES

Upon release of brakes and application of power the right wheels would not revolve. More power was applied and the aircraft began a right turn. (A left turn from parking position had been directed by tower). After 360 degrees of turn the aircraft taxied toward takeoff position.

During taxi along the ramp, observers noted that the right outboard wheel would turn about half a turn, then slide a short distance on the ice and snow-covered ramp before turning again. An observer phoned the tower which, in turn, relayed to the pilot the report that the right outboard wheel was not turning, but sliding. The pilot acknowledged this call and the aircraft was seen to stop for a brief period.

Runup was normal, ATC clearance was issued and the aircraft took off. Four minutes after takeoff the pilot reported over the range, on course.

During climb the loadmaster made another engine check and noticed a fire in the right wheelwell. He told the pilot. At this time the loadmaster observed the jump light and heard the alarm bell. The right propeller was feathered and the right engine fire extinguisher discharged. The pilot reported he was returning.

The crew chief reported that the fire was still burning. It became more intense. Flames extended from the wheel well to the horizontal stabilizer. The loadmaster and two passengers bailed out. The aircraft began to break up, rolled inverted and crashed.

This is but one of several disastrous experiences the Air Force has had with hot tires and brakes. The fact that the trend in recent years has been to increase aircraft weight and speed, or both, has tended to aggravate the situation. It's a basic physical fact that when brakes are applied, intentionally or otherwise as was true in the case recounted, there is a buildup of heat. This heat buildup, if excessive, can and does lead to fires and explosions. In this ill-fated case duration of flight was approximately 15 minutes. This is about normal. In other words, an overheated brake-tire assembly can be expected to reach a temperature-pressure peak 15 minutes after last use.

Here's another case, not so disastrous, but it could have been just as fatal had firemen arrived a few seconds earlier and approached the overheated gear assembly. Two landings had been accomplished 35 minutes apart. After the second landing the aircraft was taxied back to the hot spot, parking brake was set and the before-takeoff check completed in preparation for an assault takeoff. After taking the active runway notification was received from the tower that the left wheels appeared to be smoking. The aircraft was cleared to the end and off the runway. No brakes were used except for the final stop. The parking brake was set and the engines shut down after the check pilot verified that the left main wheels were hot and smoking. As the fire truck reached the aircraft the left aft main tire exploded, ripping the inboard landing gear door and fairing and buckling the outboard door. Inspection revealed the brakes of both left wheels had overheated and burned through the tire. The right brakes had heated to the extent that the rubber was blistered around the bead of the tire. Crewmembers reported that the brakes were used normally during the mission and that very little braking action was used after the last landing and during taxi back.

Here's one, no flight involved: During a SAC exercise, B-52s were required to taxi a great distance to the non-optimum runway. A total of seven turns and relatively fast speeds were necessary to meet the timing criteria of the exercise. At completion of the taxiback it was found that two tires had blown on one aircraft, and one tire on a second aircraft. All aircraft were found to have hot brakes with a brake change required on one.

A dragging brake was listed as the prime suspect when a fire broke out on the Nr 7 brake assembly as a C-135 rolled into a parking spot.

And here are some fighter incidents related to brake problems:

- An F-100 left the runway at the 5000-foot point when the brakes failed following touchdown on a night formation landing.

- Another '100, lining up for takeoff, lost braking when the anti-skid was turned off. After recycling, the same thing happened. The mission was aborted and cause of the brake failure traced to a faulty anti-skid detector.

- Excessive braking at high landing roll speeds was given as the probable cause when the right main gear tire of an F-86 failed shortly after landing on a 10,000-foot runway.

History gives us no indication that overheated brake and tire problems will not be with us in the future. Some materiel changes, e.g., aluminum wheels, frangible plugs and stronger tires are expected to help minimize the hazard. To further lessen the hazard here are some basic tips for all crewmembers:

- Use light braking at high landing roll speeds.
- Steer with feet lowered on rudders so as not to apply inadvertent brake pressure.
- Don't set parking brakes when hot—if necessary, have wheels chocked and release brakes immediately.
- Use reduced power when taxiing.
- Use reverse on normal landings, and as soon as practicable after touchdown in order to achieve maximum deceleration without wheel braking.
- Have maintenance personnel check for dragging brakes if more than normal power is required for taxiing.
- Apply brakes before a turn, then coast through the turn to minimize heat buildup from centrifugal side loads.
- Leave gear down after takeoff to help dissipate heat after successive full stop landings.
- Plan the mission so as to space landings on which brakes will be used.
- Write up all anti-skid and other brake system defects.
- Verify that power is reduced to idle after touchdown.
- Guard against underinflated tires.
- Check for foreign objects becoming lodged in wheel assemblies.
- Pay close attention to signs of scorching, improper adjustment, fluid leaks, abnormal tire wear and wheel binding on walk-around inspections.
- Know and comply with your Dash One recommended procedures. ☆

Ask AND YOU SHALL RECEIVE

Maj Wilson V. Palmore, Hq Air Weather Service, Scott AFB, Ill

EVER BEEN FLYING ALONG, everything fine, then for some reason you can't quite identify, the weather picture doesn't look right? Everyone has, at one time or another.

In such cases you can: 1. Do nothing, and wait and see what happens. 2. Ask, and know what is going on.

Safety demands the second of these two alternatives. Surprises, particularly when flying an airplane in weather, can be dangerous.

Following are two examples: "I was going to turn around, but the weather could have been VFR over the check point." This statement was made by a crewmember in a flight of four that almost followed their leader, who fatally crashed. The weather had been forecast to be VFR but enroute the ceiling lowered and the rain came. All aircraft, in string formation, began to descend to remain VFR—even below the lowest altitude established for the mission. At the checkpoint three aircraft broke off, changed to IFR and went home. Evidently the leader continued to descend and crashed into a cloud covered hill. Signs were ignored. The forecast was not good, and it was not questioned when obviously it had busted.

A flight of T-33's were in the local area for a fine VFR flying day. Blowing dust was noted by the pilots but no questions were asked of the tower or PFSV. A weather advisory for gusty winds and blowing dust had been issued but someone failed to call the airborne aircraft. During a hasty approach one T-bird crashed because of turbulence and poor visibility. Again the obvious was ignored. An alternate could have been reached, or the flight could have landed earlier.

As all experienced pilots have learned, conditions encountered may frequently differ from those forecast either for the good or for the bad. And whenever conditions differ, especially on the bad side, questions should be asked. Answers are available from the following resources:

- PFSV. By using 344.6 pilots can talk directly with USAF forecasters and receive enroute and terminal forecasts. The US Navy has a few UHF facilities. Most are on 344.6, but check the Enroute Supplement to make sure. The US Army has some UHF and VHF facilities. Check the flight supplements for correct frequencies.
- PTFS. (Pilot to forecaster service). The USWB in conjunction with FAA operates two pilot-to-forecaster facilities in the U. S. The Kansas City frequency is 122.6 and the other, at Washington, D. C., uses the same frequency. The Kansas City facility has been modified so that certain FSSs are connected to it by landlines. Requests can be handled through FSS direct to forecaster on FSS frequencies 134.9, 122.1, 126.7, or 255.4.
- FSS. FAA operated Flight Service Stations can provide weather observations and interpret forecasts issued by the USWB. They also can provide latest information on weather advisories and radar reports. FAA personnel have been trained as weather briefers by the USWB.
- Transcribed Weather Broadcasts. Simply by monitoring VOR at 15 minutes and 45 minutes after the hours, the weather observations can be obtained for nearby airfields. SIGMETS and advisories to light aircraft will also be broadcast on VOR. At overseas locations, selected radio beacons also broadcast weather at +15 and +45. In addition, as listed in Section III, FLIP, terminal reports and forecasts are broadcast every hour on selected HF frequencies.
- If these three sources cannot be contacted, then as a last resort ask ARTC. Normally, however, they do not have all the information you need and may have to ask for it from the local WB or FSS.

The point we want to make is that a service is available. It should be used and used frequently. Watch the weather—if the situation differs from forecast— ASK! ☆

Aerobits

SERIOUS SMOKING HAZARD. During climbout the B-47 aircraft commander lit a cigarette. Oxygen setting was 100 per cent, emergency on. No problems were encountered until he leaned forward, bringing the lighted cigarette into the stream of oxygen. The cigarette flared, the paper flamed and immediately thereafter the oxygen mask became a torch with the flame occurring just outside the mask. In order to remove the mask the pilot had to hold it with one hand while removing the chin strap with the other. He pulled off both the mask and his helmet and clamped the hose about halfway in order to shut off the flow of oxygen. Only after he had done this was he able to turn off the regulator. All flame subsided after the oxygen supply was cut off. The aircraft commander received second degree burns on the thumb and right wrist and first degree burns on the left wrist and right index finger.

T-STORM TIPS—The following statements concerning aircraft operations in and around thunderstorms are extracted from data gathered by the National Severe Storms Research Project:

- Severe turbulent conditions (u_{de}= 35-50 fps) can be encountered at some point in any thunderstorm.
- In a growing thunderstorm or large thunderstorms, extreme turbulence ($u_{de} >$ 50 fps) can be expected to be present in some part of the storm.
- It is not uncommon to encounter turbulence in the clear air near a thunderstorm or a squall line.
- Turbulence has been found to increase with altitude up to at least 5000 feet below the top of the visible cloud, and some records show possible severe turbulence even immediately above the storm cloud.
- Hail of some size is present in practically all thunderstorms.
- Current-day airborne radar is not adequate for penetration of storms.
- There is a danger in overflying growing thunderstorms. Vertical growth rates exceeding 5000 feet a minute are not uncommon.
- For current and future supersonic aircraft, water erosion and water-impact forces at altitudes above 30,000 feet may be of serious concern.

Hq Air Weather Service

B-52 STARTER DISINTEGRATION—An excellent job of airmanship was demonstrated recently when an engine starter disintegrated during the takeoff roll. No discrepancies were noted during the preflight, and the engines were started for what was planned to be a routine combat crew training mission. Taxi and takeoff were made with no abnormal indications until at 125 knots on the takeoff roll, Nr 7 engine fire warning light illuminated. (This was later determined to be due to starter disintegration.)

Engine instruments were rechecked but no abnormal indications were noted. Due to a long takeoff roll caused by slush on the runway, no attempt was made to retard the throttle. The aircraft was accelerated to 180 knots for flap retraction before Nr 7 throttle was retarded. As flap retraction was started, Nr 8 fire warning light illuminated.

The pilot was then flying the airplane

on instruments in weather (600 feet overcast). He was advised by the pilot in the IP position that there were visible flames on Nr 4 pod. Engines 7 and 8 were shut down and the aircraft was climbed through the overcast.

Visible fire continued inside the pod for another 10 minutes. When all evidence of fire was gone, circuit breakers were reset to obtain fuel flow indications on the remaining engines.

After five hours of flight, Nr 3 engine oil pressure dropped to zero with excessive EGT and the engine was shut down.

The AGM 28 missile engines were operated at maximum continuous thrust to compensate for the three aircraft engines that were shut down, and the aircraft was flown to an alternate SAC base where an uneventful landing was made.

Excellent airmanship and crew coordination enabled this pilot and his crew to cope with the inflight emergencies under low ceiling conditions and safely recover this aircraft to fly again.

Lt Col David J. Schmidt
Directorate of Aerospace Safety

NEW SAFETY AWARD ESTABLISHED. Air Force Missile Development Center, Holloman AFB, has established the AFMDC "Outstanding Flying Safety Award." The award is given in recognition of outstanding flying safety records by individuals who have had no major or minor aircraft accidents (pilot attributed). Eligibility for the award is based on total accident free flying time and a minimum of 12 months flying AFMDC aircraft. First recipient was Major Richard A. Eicholz for 20 years of accident free flying in which he amassed 10,539 hours.

ENROUTE JET PENETRATION PROCEDURES. A recent Operational Hazard Report cited that enroute penetration instructions were received which descended a T-33 aircraft to 5000 feet approximately 35 miles from the air base of intended landing. The pilot filing the OHR considered this a hazardous operation had the fuel supply been short. In reply to the OHR it was pointed out that enroute jet penetration procedures are established and utilized to expedite arrival at terminal areas. They may be refused by the pilot if he desires to continue at altitude and use a published high altitude approach procedure. Pilots accepting an enroute jet penetration procedure are responsible for assuring that adequate fuel is available for the type of penetration planned or accepted.

Harrie D. Riley
Directorate of Aerospace Safety

HOT FLYING BUCKETS—During the first six months of this year, 71 turbine wheel bucket failures were reported and 111 others were found cracked in B-47 engines.

In nearly all cases, throttle vibration gave the first indication that any malfunction or failure had occurred. Similarly, in most cases a large piece of the turbine wheel bucket was fired out the tail portion of the engine leaving a gaping hole.

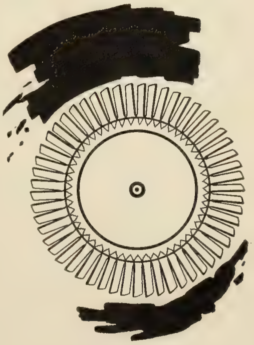
Fortunately for the crews flying these airplanes, no major damage occurred and only aircraft incidents were reported.

Numerous articles have been written on this subject, but the recent increase in bucket failures causes this writer concern over the future safety of this airplane.

Engine manufacturers and depot engine specialists long ago stated that thermal shock during starting and prolonged high operating temperatures within limits are the reasons for T-wheel bucket failures.

It is understandable that high temperatures (within limits) will be attained during certain phases of a mission, however, there are times when the pilot can contribute considerably to engine longevity.

Starting: Carefully watch EGT gages to prevent over-temperature, particularly during alert starts. If there is a chance the



Aerobits

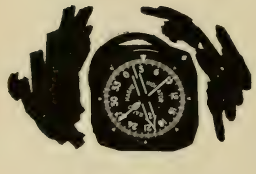
temperature was exceeded, record it in the Form 781.

Climb: Don't be too demanding of the engine unless a critical need for power exists.

Refueling: We know it is impossible to have the eyeballs on EGT gages and the tanker at the same time with only one set of EGT gages, so try not to make rapid throttle bursts. Refueling behind the KC-135 demands higher power from the B-47 to attain and maintain contact, so naturally higher temperatures will be attained.

If any question exists and the probability or possibility of an overtemp was attained, write it up in the Form 781. This is about the best insurance you have as a pilot of preventing a hot turbine bucket from separating and flying through a control cable or fuel tank.

Lt Col David J. Schmidt
Directorate of Aerospace Safety

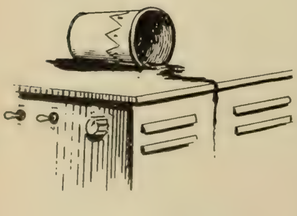


THE 40-DEGREE TACAN ERROR—Here's an OHR that gives an example of the 40-degree out-of-phase error that Safety of Flight Supplements warn about:

Inbound to Sausalito VORTAC, the mag bearing indicator registered 052 degrees. At 186 miles the DME locked on and the Nr 1 needle (TACAN) swung and locked onto a mag bearing of 012 degrees. The VOR remained on 052 degrees. The ID 250 could be rotated through 360 degrees and the CDI would remain centered. No OFF flags appeared. At 75 miles DME the TACAN was channeled to Oakland. It locked on 070 degrees (proper bearing). It was then switched back to Sausalito TACAN and it locked on 052 degrees. Operation appeared to be normal. It remained normal until the aircraft passed directly over the TACAN station, then it locked on 40 degrees off the outbound track, left of the tail. It remained there until Crockett when the pilot switched to Travis. It then locked on the Travis TACAN 40 degrees left of the actual inbound track and remained 40 degrees in error during the remainder of the approach.

WELL DONE RECIPIENT GETS VALOR AWARD. Captain Joseph B. Chiodo, Jr., 438 Ftr Intcp Sq, Kincheloe AFB, Mich, has been awarded the Aviator's Valor Award. Captain Chiodo was named the 1963 recipient of the award for his courageous and professional handling of a severe and unusual malfunction in the elevator control of his F-106 during a flight over Canadian bush country. The award is presented by American Legion Post Nr 743 of New York City to a living member of the Air Force for a conspicuous act of valor or courage performed during an aerial flight in or out of combat.

Captain Chiodo received the Air Force's Well Done award in December, 1963, for this flight.



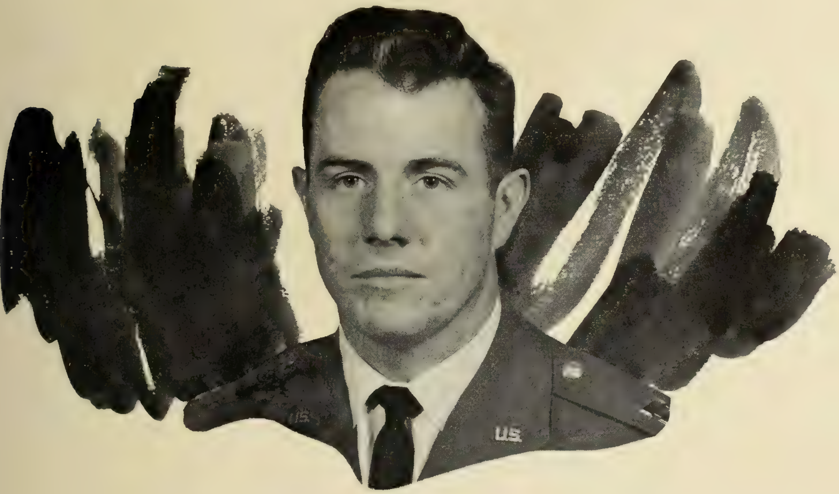
COFFEE: HAZARDS AND COSTS—From the Trans Canada Airlines publication, The Grapevine, comes the following:

"Several items in the Grapevine over the past years have mentioned instances of unit contamination by spilled coffee. The units have ranged from oxygen regulators through radio tuning units to—most recently—DC8 autopilot controller units. There have even been instances of coffee spills on Viscount radar indicator units.

"Replacement and cleaning of these units costs a lot of money. Spills also create real hazards: shock, failure of a critical navigation unit, loss of a safety system, fire, smoke. Sudden turbulence, etc., make some of these spills unavoidable. Many of them, though, would appear to be carelessness. Most can be avoided by using the coffee cup holders, which are installed in all aircraft types, and a gentle suggestion to the flight attendant that the cups not be over-filled."

Good advice for USAF crews, too. ☆

WELL DONE



CAPTAIN ROBERT E. HANEY

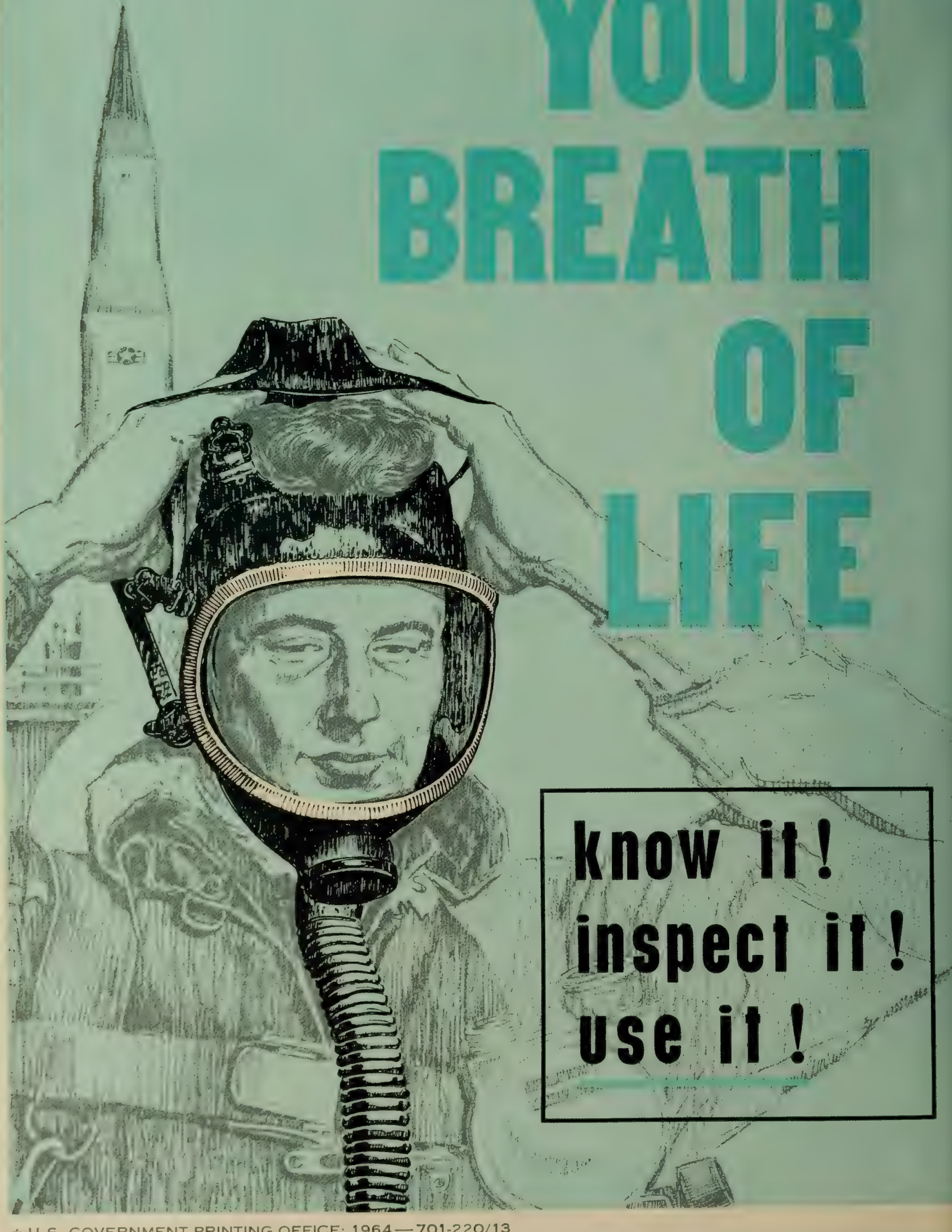
366 TACTICAL FIGHTER WING, HOLLOMAN AFB, NEW MEXICO

Captain Haney was on a routine, periodic inspection test hop in an F-84F. The takeoff and initial portion of the flight were uneventful as he went through the checklist, testing one system after another. As he raised the landing gear after completing a low airspeed controllability check, the control stick snapped violently forward. Before he could get his hand back on it, the stick snapped back toward him and stopped. In the short seconds that this took place, Captain Haney realized that he was perilously close to minimum control speed and that if the stabilator jammed in the nose-up position, his aircraft would be out of control. The stabilator was jammed in a position which would permit level flight at 180 knots. Captain Haney called another pilot who was in the area and had him look the aircraft over. Nothing appeared damaged, but movement of the stabilator was limited to little more than one inch up and down.

Captain Haney maintained 23,000 feet and flew a simulated landing pattern. He found that he was able to control the descent through careful use of power and the very limited movement of the stabilator. Once he determined that the F-84 was controllable during landing approach, he descended to the field and made a long, straight-in approach and perfect landing. The stabilator control rod was found to be broken loose near the mechanical advantage shifter.

Through calm and professional analysis of a serious problem, and careful evaluation of the controllability of the aircraft before committing himself to a landing, Captain Haney saved the Air Force a valuable fighter aircraft. Well Done!

YOUR BREATH OF LIFE



know it!
inspect it!
use it!

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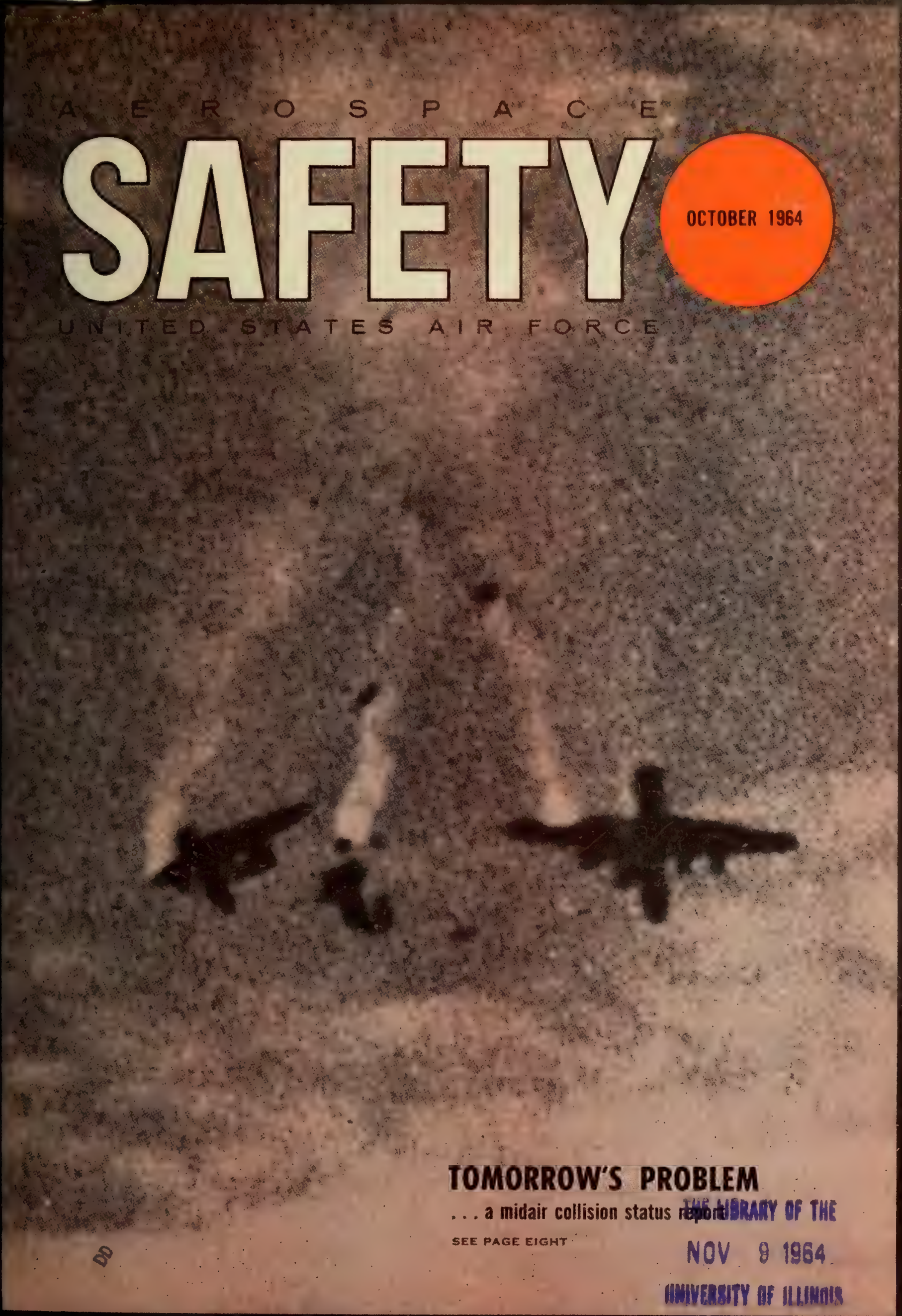
AEROSPACE

SAFETY

OCTOBER 1964

UNITED STATES AIR FORCE



TOMORROW'S PROBLEM

. . . a midair collision status report

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AEROSPACE SAFETY

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AFRP 62-1 OCTOBER 1964 NUMBER 10

FALLOUT

WELL DONE AWARD

In a recent survey, in answer to the question "What can be done to further reduce the number of accidents?" I recommend that the AEROSPACE SAFETY's "Well Done" and INTERCEPTOR's "We Point With Pride" programs be canceled or drastically revised. I make this recommendation because far too many pilots are publicly praised for saving aircraft when one salient point is overlooked. That is bad judgment. The pilot in one brief referenced in the survey might as well have shot himself in the left temple, *but if he had made it,* he probably would have received a "Well Done!" Bad judgment is bad judgment. If a pilot elects to take a chance in a marginal situation and things are going right for him that day and he "lucks it in," he is to be congratulated on his good fortune, not on his good judgment. Please stop telling him what a skillful fellow he is. Stop telling the entire Air Force what a splendid job it was, when two pages before, Pilot X who tried it and bashed is held as an example of bad judgment.

Let's not make success the tight rope between "Well Done" and "Pilot Error." The adage "You can't argue with success" has no place in accident prevention programs, because Pilot Y, reading about Pilot X and his "cool and accurate evaluation" and "high degree of professional skill" may be encouraged to try a duplication or even to exceed Pilot X and his deed.

Not all awards of course are to lucky pilots who took a chance and made it, but enough do creep in to make another person wonder a bit how he would react if he were involved in a similar situation.

If a pilot saves one through a combination of skill, luck, and questionable judgment he deserves a word of thanks, a congratulation on his fortune and skill, and perhaps a word or two on how close he came to being a bum. But let's have it at the bar with the C.O. and the troops, not splashed in a magazine with "Safety" in its title and accident prevention in its purpose.

Capt. Ronald B. Weinert
Flt Cdr 190 FIS, ANG
Boise, Idaho

The criticism above has been voiced before. "Well Done" nominations (AFR 62-9a) are screened by a Board of Pilots at DTIG and only those whose accomplishments are attributed to good judgment as well as skill are selected for the award. Recognition is considered an important aspect of accident prevention and "Well Done" awards are a part of the USAF recognition program.

Dash Ones and other directives attempt to provide guidance for all anticipated situations and they are to be followed. Such directives, augmented by good pilot judgment, are expected to provide the best assurance of safety in any situation.

SAVINGS WITH SAFETY

We've been hearing a lot for some time now about economizing, cutting costs where possible, looking for new ways to do things better and cheaper. The label for the whole effort is Cost Reduction and a number of projects have been placed into effect, for example, Project Ice.

Efforts to this end have taken many forms. "Why Use Two When One Will Do," over paper towel dispensers; "Turn It Off," referring to electric lights. Some of these efforts are aimed at saving pennies, others are massive campaigns with far reaching effects. The list could get pretty long and there's no use repeating all the slogans that have been coined to publicize this subject.

The point is, the nation and consequently the Air Force, does not have unlimited resources. We're all taxpayers and we feel the bite when Uncle takes his bit to keep this country operating. Therefore it is of interest to us all to keep costs to a minimum, but we can't always be looking at the other guy and worrying what he's doing about it. The place to look is closer to home. What am I doing about it? How can I contribute to the effort which in the final analysis will directly benefit me?

One of the best places to start, in my opinion, is in accident prevention. Obviously if the destruction of an aircraft or a missile can be avoided a tremendous savings will result. How much does a B-58 cost? Or a Titan missile? These are big, extremely expensive pieces of hardware and the savings are big. But what about some not-so-expensive items that when added up run into those big millions of dollars figures?

A rock on the runway causes a tire to blow out on a fighter plane. Another aircraft sucks up a bolt into the engine intake causing an expensive overhaul plus an aircraft out of service. A tug towing a missile backs into the side of an aircraft. A set of chocks not used allows a transport to roll into some parked equipment causing extensive damage. Failure to use a safety cable allows a propeller to fall from an A frame —the prop is damaged, but more serious is the loss of the airman when the prop hit him in the head and killed him.

Pick any kind of mishap you like, from the everyday nickel and dime type up to the more weird ones such as the use of oxygen instead of nitrogen to purge the fuel tanks of a B-52, which caused a fire that destroyed the bomber. It has happened somewhere sometime. Trouble is, we know that any kind of mishap you want to mention CAN happen again. And it can cause the loss of an aircraft, or a missile, or a life.

I started out talking about cost reduction, now I'm on the subject of accident prevention. Well, cost reduction may not save lives or prevent accidents, but it's a safe bet to say unequivocably that accident prevention is cost reduction. So while we're thinking up slogans and issuing certificates for achievement in cutting costs let's remember that we've got a great big area here where we can save the Air Force millions of bucks, a lot of lives and combat capability in the simplest way imaginable—by just doing our jobs correctly.

This has the ring of a sermon about it, but no matter how you look at it you can't get around the fact that resources can be wasted through carelessness, stupidity and ignorance. Carelessness is a personal thing, something each of us can do something about. Stupidity must be eliminated. Ignorance can be overcome by training and good supervision.

How about it, can't we get a real cost reduction program going by doing everything possible to eradicate what we all know are preventable accidents? ☆

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

The Accident That Didn't Happen

If it had, could the cause have been found?

Maj Frank L. Hettlinger, ANG, Hulman Field, Terre Haute, Ind.

It was a beautiful Sunday morning and the weekend cross-country trip had gone well. The mission for the day was to return to my unit, deployed 1500 miles from home station. For the F-84F, this meant an intermediate stop, but with excellent weather across the entire route, I anticipated a "no sweat" flight.

Immediately after my wingman and I became airborne at 1300 hours, he informed me that his landing gear handle would not go to the up position. After several unsuccessful attempts to retract his gear, we decided to abort the mission.

Back on the ground, I was notified that an ORI Team had arrived at the deployment site, and since I was the operations officer, I was to return ASAP. This bit of, "the last thing I want to hear," type of news was to haunt me all the way back.

We again became airborne around 1530, with my wingman using the override system to retract his gear. An uneventful two hour flight brought us to our intermediate stop where a fast one hour turnaround provided us with food and fuel.

We gained an hour at this point and were going to gain one more before arriving at our destination. We decided not to reset our clocks until we landed. Takeoff then was made at approximately 1900 hours. This time I flew the wing position to spread the workload around a bit. Darkness prevailed the last half of the flight which demanded a higher than normal degree of attention. One hour and forty-five minutes later we taxied into the parking area.

I was greeted by troops in various states of confusion and handed all the TWX's that had been received relative to the ORI. The first task was a head count which revealed only about 60 per cent of the pilots available. The remaining 40 per cent were spread out on rotational and other TDY exercises. A majority of the 40 per cent were the flight commanders and assistant flight leaders, since all requirements for these duties demanded "well qualified" people.

A schedule was made up for the next day's flying. This consisted of 12 sorties of dive bomb, skip bomb, rockets and strafing in the morning, and 8 low level LABS sorties in the afternoon. Another fly in the ointment! No published low level routes for this base. After considerable effort a group of us drew up an acceptable route terminating over the LABS target. By golly, I'm tired. A check of my watch shows 0200! Time to reset to local time, midnight. Now I didn't feel so bad.

All the details taken care of that I could think of, I headed for the shower and hit the pad around 0100 hours local time. But I couldn't sleep. All kinds of ideas, notions, thoughts, etc., ran through my mind. Seemed like I was checking my watch every five minutes too. The night dragged by slowly and finally it was 0430. Time to get with it.

Breakfast tasted good, and I felt pretty good. A mass, painstaking briefing was held at 0600 hours. None of us had ever dropped a bomb or rocket on this range, and very few of us were lucky enough to get some strafing in before the weekend. Nevertheless, we pressed on under the pressure of pencils in the hands of the emotionless inspectors.

The tight schedule required the services of every pilot, including myself and the squadron commander. I was the flight leader on the third flight of four aircraft. We found the targets OK, but it was apparent that there weren't going to be many in the scoring column by the end of the day. I was getting somewhat disgusted with the whole thing by now. Felt a little tired, too.

During the lunch hour, I compared notes and prepared for the afternoon's missions. I found myself scheduled to fly the fifth low level and LABS sortie. Seems like the theory was to get the more experienced lads on this phase to try and salvage a portion of the day's activity.

Walking to the aircraft, I can remember having that feeling of heaviness of limbs and of someone tightening a band around my head. I knew I was dead tired, but I was still thinking straight. A fast walkaround of the bird, then I cranked up and made good my takeoff time to the second. Sure was tired though! Been tired before, but this had a new twist to it. Caught myself narrowing my attention to fewer items than I was used to. Oh, well. So what? The bird's running OK. Only thing I had to do was hit my low level starting point on time and make good that bomb impact time.

Time to hit the deck. Down I went, leveled off a good 500 feet above the ground, set course and airspeed and passed over the shack near the railroad track right on the money.

The first leg went like clockwork. Most of it over flat desert. I was hacking checkpoints within 15 seconds, but I wasn't enjoying this trip at all. The heat in the cockpit wasn't helping matters either. The second leg required climbing over some 5000 feet high mountains and quite a few altitude changes along the route.

Seems to me I'm doing a lot of mechanical flying on this flight. Watch it, boy! The ground got awfully close that time. Running 20 seconds slow on that checkpoint; need a bit of power to catch up. Looks a little high now. What kind of low level run is that? Get it down where it belongs. Thirty seconds fast on the next checkpoint. What gives? Back off with that throttle. Come on, keep it at 500 feet!

On the last leg now and having a fight with myself. Keep thinking to heck with the whole thing, but I had to keep pushing and get this chore over with. Felt tight all over and sweating like blazes. There's that last checkpoint before power pushup. Time looks good. Should be picking up that run-in line about now. Yeah! There it is! Full bore now. Need 504 knots indicated for this run.

I checked in with the range controller who cleared me in. About a minute to go now. Speed almost on. Uncage gyro. The range controller's voice comes through my headset loud and clear. ". . . running in on the wrong run-in line, abort your pass." Abort, hell! I remember briefing about this possibility and know that the correct run-in line was off to my left and parallel to this one. I racked the '84 into a steep bank to the left, picked up the right run-in line and rolled out on course. Geez! Nearly blacked out on that correction. Don't forget the switches! There's the target. Ease in on that 4-G pull, now! Up over the top, roll off and check over the shoulder for the hit. Better turn my switches off. What the . . .? They're all off! Can't be! I swear I turned them on.

The range controller called a hit well outside the ballpark. Sure enough, there's the smoke! So what, who cares anyway? But what about those switches? Right here I have a flash realization that I must be doing things without thinking about them. Seems like the whole flight has been going this way. I better get this "Hog" on the ground, but fast!

I called the tower for landing instructions. Nothing new here. Same old story about a right break; call the initial approach. I screamed down into a descending turn to the initial approach, knowing all about some local procedures describing the correct way for entering traffic. Who needs 'em? I called the initial approach and the tower requested a gear check on base.

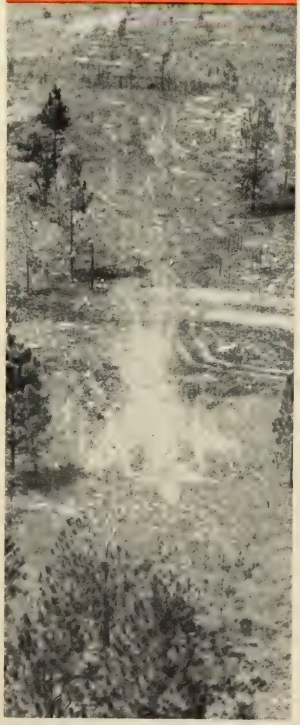
I broke hard left. Halfway around the break the tower explodes, "Right break! Right break!" I got the message and mumbled out loud, without pushing the mike button, something about everybody ought to relax. I immediately whipped that '84 into a 90-degree turn so as to roll out on a half-decent down-wind leg. Somehow I managed to put the gear down and landed without further incident.

I don't know what I did the rest of that day, but I do know I couldn't care less about anything. I didn't know how bad a physical and mental shape I was in until the next day after a good night's sleep. The more I thought about the way I conducted that flight and the irrational thinking I had performed throughout that day, the more I shook all over. It was apparent to me then that I had experienced a serious condition associated with fatigue.

All that I have ever read or been told about fatigue since then has made an alarming amount of sense. And I wonder sometimes how many of us have to experience it before we are really made aware of its causes and consequences.

The final question then is, if an accident had occurred, how many investigators would have considered fatigue as the primary cause? ☆

...THE ONE THAT DID



NO ESCAP-ABILITY?

Robert H. Shannon, Staff Safety Officer, Life Sciences Div, DTIG

The lack of a reliable low speed, low altitude escape capability was tragically demonstrated in a recent F-104B accident when two pilots attempted ejection during a landing emergency. Both pilots were killed because of insufficient time for completion of the ejection sequence.

Accident investigators determined the following as the most probable sequence of events:

Approach and touchdown were apparently normal. About 400 feet after touchdown, which was slightly in excess of 1000 feet from the approach end, the aircraft veered right and the right tip tank fins struck the ground. The aft portion of the right tip scraped intermittently on the runway for another 941 feet, at which time the aircraft went off the right side of the runway. It continued through the soft, sandy infield between the runway and an adjacent parallel taxiway, across the taxiway, coming to a stop some 240 feet beyond the taxiway. The underside of the fuselage was damaged extensively and the landing gear system was destroyed; however, the aircraft was essentially intact.

The pilot in the front cockpit ejected midway between the runway and adjacent taxiway. The trajectory height of the seat/man mass was estimated by witnesses to have been slightly over 80 feet. Seat separation occurred at the apex of the trajectory but due to insufficient aerodynamic drag, the parachute did not deploy. Forward speed of the aircraft at time of ejection was just under 100 knots which is less than the minimum speed listed in the Dash One.

Investigation of the pilot's egress system disclosed that the T17E4 Seat Thruster failed to retract and lock, resulting in failure of the primary M-27 initiator to fire. The secondary or backup initiator took over and fired the catapult normally. All other components of the egress system functioned properly.

The rear cockpit occupant ejected two to three seconds after the pilot and in the vicinity of the taxiway. There were no witnesses who observed this ejection. The seat impacted in trees alongside the taxiway while the rocket motor was still burning, consequently it is believed that the ejection trajectory was very flat. The ejection probably occurred when the aircraft was in an excessive left wing low attitude as it skipped across the taxiway at a speed of approximately 50 knots. The man separated from the seat but the shroud lines of the chute were found intact within the quarter bag. Heat damage to the rear canopy disclosed that the canopy adequately protected the occupant from the rocket blast of the front seat.

The reason for the ejection of the crewmembers could not be determined; however, as the aircraft was veering in a right arc, deceleration forces forced the pilots against the left side of the cockpit and probably caused them to believe the aircraft would roll. This is considered to be a deciding factor which influenced the ejection decision. The tragedy of this accident is that in all probability neither pilot would have been seriously injured had they not ejected, since the aircraft remained upright.

It is difficult to assess the pilots' decision to eject in this case; obviously, they made a wrong decision, however, had the aircraft rolled they may have been seriously injured or killed.

This accident again re-emphasizes two very important points:

First, the decision to eject or not to eject under such circumstances must remain with the pilot. Second, there are too many variables, usually peculiar to each individual case, to establish specific guidelines.

Some history of previous ground ejections and emergency landings may help you to formulate a plan of action in the event you are confronted with such a decision. From 1955 through the end of 1963, there

were 34 ground level ejections from USAF aircraft. In the majority of these, the conditions at time of ejection were non-survivable, in that little or no forward speed prevailed. Of the total, 18 (53%) resulted in fatalities; 15 (44%) crewmembers received major injuries and one was uninjured. It must be emphasized at this point that in only one of the successful ground ejections was the system used as designed and under conditions necessary for survival. In this case, at the time of ejection the aircraft had a forward velocity of between 200—220 knots and all components of the escape system functioned perfectly. In other words, this man had everything going for him. In the other 15 cases, survival was attributed to a lot of luck and not the complete operation of the system (seat separation and fully deployed chute).

A study of survival following controlled crashes, by Col Emmert C. Lentz, Chief, Life Sciences Div., Assistant for Medical Services, disclosed that during the 2½-year period, 1 January 1960—30 June 1962, there were 317 such major accidents involving jet fighter/jet trainer aircraft. These accidents involved 427 total personnel with 26 (6%) fatalities and 47 (11%) major injuries. Six of the 26 fatalities resulted from ejection and are included in the above. Thus, only 20 fatalities occurred during controlled crashes. This represents one fatality for every 21 crewmembers exposed as opposed to one fatality in every two ground ejections. Colonel Lentz' study also disclosed that entrapment due to a crash landing is remote. Only three fighter/trainer aircraft ended up inverted. Modern aircraft show a remarkable resistance to flipping onto their backs or to cartwheeling. Entrapment in a fighter/trainer type, due to inability to open the canopy, also is a remote risk.

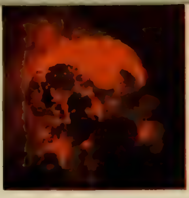
On the basis of these data it is readily apparent that (once the aircraft is on the ground) the chances of survival in a controlled crash are far greater if you stay with the aircraft. This is particularly true since we DO NOT YET HAVE A TRUE ZERO-ZERO ESCAPE CAPABILITY. In the case of a catastrophic sequence of events that can only terminate in a fatality, such as a high speed collision with a tree, ditch, etc., then perhaps ejection would be the only alternative.

The other point to be emphasized is that a forward speed of 120 knots is a prerequisite to our present zero altitude escape capability. The present rocket assisted seats do not provide sufficient trajectory for completion of chute deployment. The zero altitude capability as outlined in the Dash One was determined through flight and sled tests. Operational experience has repeatedly shown that successful escape under these conditions is contingent upon an IDEAL situation.

Improved low and slow ejection capability is currently being tested for the F-106. Efforts will be made to achieve a zero-zero capability during these tests. This will be accomplished primarily with a high energy rocket catapult, capable of obtaining trajectory heights in excess of 400 feet. A similar catapult is scheduled for installation in the F-105.

This headquarters will continue to lend all possible support to help obtain an optimum escape system for USAF aircraft. Other encouraging component improvements receiving attention at this time include drogue chute stabilized seats and forced parachute deployment.

Ed. Note: As the above was being written, a student pilot successfully ejected from a T-38 aircraft, at ground level. The forward velocity of the aircraft was 135 knots and all equipment functioned properly, including complete parachute deployment. ☆

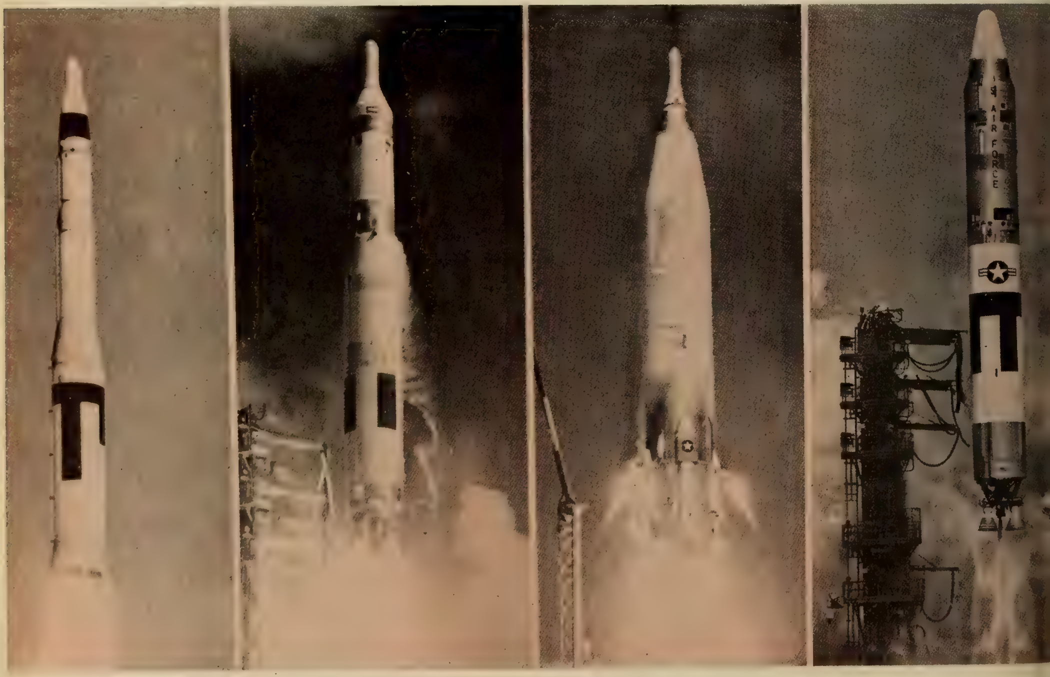


The Missile Decade

In May of this year the Air Force celebrated the tenth anniversary of the missile age. In this brief period of time the Air Force arsenal has been augmented by several hundred combat ready intercontinental ballistic missiles. Never before has there been implementation of a complete new weapon system of such scope and destructive power.

Much of the technological skill of the nation was devoted to this effort. And, to meet the timetable dictated by world events, a new design-development philosophy had to be adopted and practiced—concurrency. (The concept of concurrency is defined as the meeting together at one time of several different scientific, technological, training and other developments so as to reduce the amount of lead time in achieving a given capability.)

Many break-throughs were necessary. Unprecedented weight savings had to be practiced. An aggressive effort to miniaturize components was undertaken. Guidance systems, plumbing, pumps, actuators of all kinds, even the skin of the boosters had to be shaved of unnecessary ounces. Temperature and pressure ranges



never before encountered had to be tolerated. New metal alloys had to be developed to insure integrity under these conditions.

The success of these separate but related efforts is now history. Not only does the Air Force have several hundred operational ICBMs deployed, but also, reliability of such weapon systems was demonstrated most conclusively by the manned orbital flights. Thrust for these flights was supplied by basically the same boosters that stand ready to launch nuclear warheads should retaliation become necessary.

Were it not for continuing demands for technological progress and refinement of present systems, it would be possible to pause and reflect in detail on the accomplishments of this past decade. But just as this decade has proved that unprecedented progress is possible, it also has illustrated the demand that these skills be exercised, not merely reflected upon.

There is another aspect of the missile decade that warrants comment. This aspect is not one to consider with such obvious pride, but it is just as necessary if achievements realized are to be exploited to the maximum. This is the matter of reliability.

It stands to reason that any system as complex as an ICBM, with its attendant servicing problems, its critical tolerances to temperature, pressure and moisture, its computerized components and support equipment, its exotic and potentially hazardous fuels—any such system is bound to create operational and maintenance problems second only to those encountered in its conception and development. In addition, security has dictated another vexing requirement for those charged with the care of these birds—deployment underground in heavily reenforced silos and with a network of tunnels and rooms in the support and control complex. Here, where ventilation and humidity are continual environmental headaches, and where necessary exercise of components and systems holds high disaster potential, the continuing price of the missile age is being exacted. The inspiration that comes with the birth of a new system has passed; now is the mundane chore of meticulously watching over the buried birds to see that they are always ready, and to assure that the greatest technological product of any decade is not wiped out by accident.

Problems, as yet not all known, lurk in these missile silos. Corrosion alone—between metals, between grain boundaries of metals, between metals because of electrolytic or heat treatment action—is a major area that is requiring a field of technological effort all its own. Leaks have been trouble sources in weapon systems since the days of the first airplanes. They still exist. Systems which repeatedly give trouble when subjected to maximum pressures of 3000 psi forewarned that fluids flowing through similar plumbing, with similar seals and fittings, would be prone to leak in missile complexes. Increasing pressures to 6000 psi and more have, as would be natural to assume, only added to this hazard.

And sometime, down in the confines of the missile silo, petroleum products, liquid oxygen, and other fuels are in close proximity. Under the rigidly controlled conditions and in the checklist sequence for which the system has been designed, performance is as advertised. But, as a few spectacular explosions have shown, a small leak, a minor deviation from approved procedures, a component malfunction and a terrific price must be paid for a missile age weapon system accident.

Obviously, the loss from this cause would be much higher were it not for a group of unsung Air Force airmen and officers. They have a devotion to duty and self-discipline that motivates them to meticulously examine each and every component in each and every complex time after time. Their alertness and religious reporting and repair of worn, leaking, corroding equipment is the greatest single factor in prevention of missile accidents. Detection of discoloration, monitoring of gaseous oxygen detectors, noting changes in sound as a bearing wears, cleaning up spills immediately, repacking a leaking pump, verifying free flow through filters—these are the things these launch crewmembers do, over and over again, and with little recognition. These things they must do to preserve the multi-million dollar birds hatched in the missile decade.

As to a forecast for the next decade—it would appear to be as complex, as demanding, if not more so. The more that's known of a technology and the more its ramifications, the greater the potential for technological break-throughs. Miniaturization, expanded use of computers, lasers—these are some of the areas that shout of potentials that must be exploited. New methods of bonding high heat resistant metals must be found. Vibration studies must reveal a means of reducing stress. Component durability must equal that of the system. More efficient, more accurate and more reliable systems can be anticipated. Space age requirements continue and as each new possibility becomes reality complementing technologies must meet the challenge.

And one of the greatest demands in the foreseeable future is that put on people; not just the scientists and engineers who make refined systems possible, but the Air Force blue suiters who now care for systems in being and who will be called upon to care for those to come. Because of the pressures of progress in the missile age there is not always development time to thoroughly evaluate and refine each weapon system and its components before they are put on operational status. Air Force crews who man the sites must not only perform routine maintenance and operational system exercise, but must perform duties as research and development monitors. The feedback of information they can provide as a result of observations learned during their daily rounds and frequent exercises is absolutely essential if the full potential is to be realized and incorporated into subsequent missile systems. The press of expediency, dictated by world events of the post WW II period, forced adoption of the concurrency concept. A large, operational arsenal of ICBMs within the past decade is proof of the fact that such a concept is feasible. It may vary in degree, but the press of modern technology demands that it be continued in some degree.

And so the role of the Air Force airman has taken on a new significance. His contribution, though it lacks the glamor of an astronaut's flight or a moon-probe launch, is essential if progress in the next ten years is to fulfill the potential exposed during the past decade. ☆

Tomorrow's Trouble

. . . A Midair Collision Status Report

The objective is to describe the midair collision hazard, how it has changed, and what the pilot can do to help himself avoid a midair collision tomorrow. Unfortunately, it's the magnitude of the problem, not the clarity of the solution that makes another article on midair collisions appropriate. The following table is an indicator of that problem.

T-33	T-37	F-105	C-54	T-33
F-100	T-37	KC-135	C-97	F-102
T-38	C-119	T-37	F-84	KC-135
T-38	C-119	T-37	F-84	KC-135
F-102	F-100	F-100	T-33	F-102
F-102	F-100	F-100	T-33	Light Plane

The above is a partial listing of midair collisions experienced by the Air Force during the past year.

To see what can be done to prevent tomorrow's midair collision—the one you are really interested in—let's now consider some factors bearing on this problem as they have been identified in the past. Following are conclusions in an article and a study prepared by Anchard F. Zeller, Ph.D., Directorate of Aerospace Safety. Both the article and the study were published more than five years ago, but they are as appropriate today as they were then. Some improvements, primarily that of greater use of radar in air traffic control, tend to be offset by increases in airspeeds, altitudes that must be transited during climb and descent, and numbers of aircraft.

Here are some pertinent aspects of the midair problem, as excerpted from work published five years ago:

Air Force accident experience shows that approximately four out of five midair collisions occur under visual flying rules (VFR) in daylight conditions. Most are within 20 miles of an airfield and occur at relatively low airspeed.

When the assessed causes of the accidents are considered it is apparent that by far the greater number of these are related to either errors of omission or commission on the part of the pilot. In order of frequency these errors relate to failure to see the collision object, a misjudgment of distance, or failure to take corrective action in time to avoid a perceived aircraft. Other errors are committed by such persons as instructors, flight leaders and supervisory and ground support personnel.

HUMAN FACTORS

In any human activity, considered in conjunction with the operation of a piece of equipment, there are three sequential steps that must be followed. This perception-decision-response cycle is always involved. In order of frequency the errors committed in midair collisions fall roughly into the same sequence; that is, the greatest number of errors are related to perception, the second greatest to decision and the third greatest are related to inappropriate decisions and judgment and responses.

The average time taken to read a standard Air Force aircraft altimeter is seven seconds. During this seven seconds a pilot in a standard jet penetration from 20,000 feet at 350 mph, in a rate of descent of 5200 fpm, travels 3600 feet along a flight path and descends 600 feet vertically. Any shift from one instrument to another within the cockpit takes time. The actual lateral movement of the eyes will consume five one-hundredths

The spectacular photos in the panels below were made seconds after two transport aircraft collided in midair over the Atlantic. The camera crew that made these pictures was filming a sequence for a motion picture at the time and was therefore able to document the tragedy. The aircraft involved had been flying formation in support of the project when they ran together.

of a second while traveling through 20 degrees. If a person looks into the cockpit, looks outside, and then re-focuses on the instrument panel, a minimum of two seconds has elapsed.

Other activities are even more time-consuming. When an instrument flight plan must be followed, the time spent monitoring the instruments is much greater, even under VFR conditions. Under emergency or anticipated emergency conditions, even more time is spent looking inside the cockpit.

Even if the pilot is looking outside of the cockpit, there are limiting factors. First, the available space which can be scanned is restricted to the area which can be observed through the windshield or canopy. Even though vision is unobstructed and the object is clearly in focus, an aircraft, particularly a fighter aircraft, on a head-on collision course, presents a very small target, and the distance at which actual visual identification is possible is limited to a few miles at the most.

At high altitudes the eye has a tendency, when looking into space, to automatically focus only a few feet in front of the individual.

Even when straight line courses are involved, the problem of determining whether or not another aircraft is on a collision course is relatively difficult but this difficulty is magnified many times when either or both of the aircraft involved are flying in other than straight line courses. The problem of judging rate and of projecting curvilinear paths by visual reference to open space is almost outside the pilot's capability. High closure rates aggravate this problem.

The decision must be made rapidly and accurately because, in most instances, once the pilot has committed his aircraft to some type of maneuver, insufficient time remains for major correction.

Even after an oncoming aircraft is discerned, and the decision to take evasive action is made, another delay ensues to allow for the modified airflow to produce sufficient deviation of the aircraft from the original flight path for a collision to be avoided.

Under relatively optimal circumstances the minimum perception-decision-response lag, together with the machine lag, has been determined to be about five seconds. Even using the assumed minimum figure, two aircraft on a collision course at a combined rate of closure of 1200 mph will be a mile and a half apart five seconds before collision. Under optimal circumstances a collision could be avoided. At these speeds, if the aircraft were closer together than this before one of the pilots observed the other aircraft on a collision course, a collision would be essentially inevitable.

In his reports Dr. Zeller went on to point out that there are many other limiting factors, all leading to a further degradation of the efficiency with which the perception-decision-response sequence is initiated and hence increasing the probability of midair collisions. Among such additional limiting factors he listed cockpit design, design of the aircraft itself, background, training and experience of the pilot, chronic requirements for additional attention on one or more facets of the operation, boredom and fatigue, oxygen deficiency and poisoning from fumes, the mental state of the pilot at the time, age and physiologic incapacitation regardless of age.

SOLUTIONS

Here are some solutions dusted off from five years ago.

Added emphasis upon training pilots in various procedures and techniques can undoubtedly result in the elimination of many midair collisions, but as was explained above, many midair collisions are the result of the pilot's finding himself in a situation which exceeds the capability of the man and machine.

Additional scanners, when this is possible, will help. Crews of multiplace aircraft find that, when they have all crewmembers scanning, more aircraft will be seen, and seen sooner. Accident histories demonstrate that aircraft with more than one pilot, particularly those with a side by side seat configuration are involved in fewer midair collisions than other types of aircraft. It should be pointed out, however, that human limitations are as applicable to two persons as to one and that additional scanners can be expected to eliminate only a fraction of the midair collision accidents.

Some improvement could be expected with modification of aircraft to increase visibility and improvement of design of the cockpit to reduce the complexity of the pilot's task. This is an aspect most pilots have no control over (unless they habitually place reflective materials on the glare shield).

Any means of increasing conspicuity would be of some help, but probably not to the extent once expected. Studies with conspicuity paints have shown that the eye

Tomorrow's Trouble continued

discerns the object before it discerns the color. Additionally, actual possible space available for the pilot to scan is restricted and aircraft approaching from many angles may not be seen no matter how conspicuously marked. Further, accident histories indicate that most collisions of the non-formation type occurred when one or more of the aircraft were following a curvilinear course immediately prior to the accident, which makes judgment regarding possible collision extremely difficult. Improved lighting should be useful, but over four-fifths of all midair collisions occur during daylight hours in good visibility. Other proposals considered in the conspicuity area have included such things as smoke puffs, vapor trails, coded light signals to indicate direction and optical devices such as binoculars and rear-view periscopes. (Don't count on any of these to help you on your next flight.)

One area in which improvement has been realized is in traffic control. Increased radar coverage and expansion of positive control airspace has contributed materially to reducing the midair collision risk. VFR radar service has helped to reduce the hazard in terminal areas.

ELECTRONIC DEVICES

What about electronic devices? To learn what has been developed in these areas in the past five years that will help the pilot on his next flight, we checked with the Chief of the Research and Engineering Branch of the Directorate of Aerospace Safety. He explained that development and control responsibility of such devices was given to the FAA in 1958. At that time the Air Force closed out their programs and established necessary liaison with the FAA to insure that Air Force requirements were understood. Generally, research in this area tended to show that many techniques that had been advanced were impractical. FAA's main effort was in improved traffic control. The consensus is that improved traffic control has tended to reduce the hazard in control areas, but there are many areas, tactical training routes and areas and training command flying training areas particularly, where no progress has been made. Due to the increase in the number of general aviation aircraft, and their operation in airspace outside of FAA positive control areas, this hazard may be greater than it was five years ago. Recent Air Force midair collision experience leaves no doubt that it still exists.

The Chief of the Research and Engineering Branch is a member of FAA's Collision Prevention Advisory Group (COPAG) an organization made up of members from the FAA, Army, Navy, Air Force, Air Transport Assn, other governmental agencies, industry and various safety organizations concerned with methods of solving the midair collision problem. This group is attempting to set up a meeting with an aircraft manufacturer that, reportedly, has developed and uses a collision warning device in its flight test area.

Airborne devices to minimize midair collisions fall into three general categories:

Collision Avoidance Systems (CAS) that will detect aircraft, evaluate the collision threat and determine the escape maneuver to be executed by the human pilot or the autopilot.

Pilot Warning Indicators (PWI) that will alert the pilot to aircraft in the same area and provide bearing, range or other appropriate information to assist the pilot in locating the other aircraft.

Conspicuity enhancement.

No practical CAS or PWI system has been developed that will help the pilot tomorrow.

Conspicuity enhancement was probably best known for the conspicuity paint on military aircraft in the past few years. However, in the spring of 1963 the Air Force decided to discontinue conspicuity markings except for ATC and tactical aircraft (other than century series fighters) used primarily for pilot training and target aircraft. Reasons given were:

Expense of application and maintenance;

Existence of other programs to reduce near collision potential; and

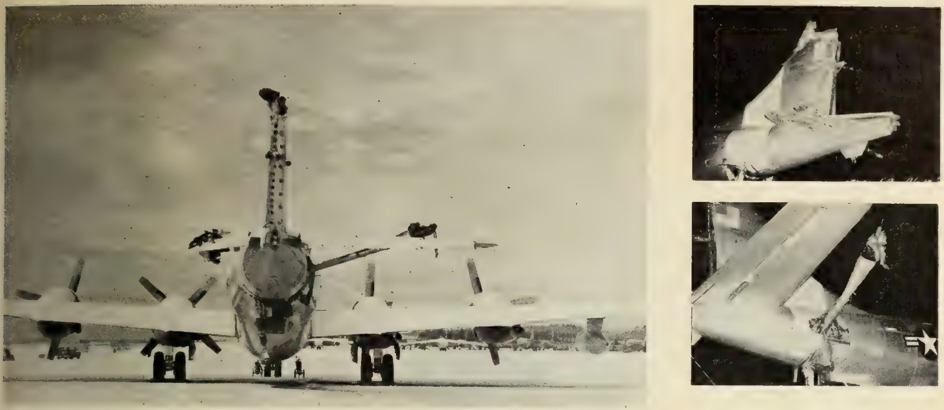
Lack of conclusive findings, either from operational statistics or research studies, as to the safety value of the markings.

This program was on a one-year trial basis to see if midair collisions increased. The program was monitored by the Directorate of Aerospace Safety. There was no significant increase in midair collisions and the conspicuity paint program for all military aircraft has not been reinstituted. Again, it may be well to point out, research in this area indicates the eye sees the aircraft before it discerns the paint.

EXAMPLES

Information gleaned from near-collision and collision reports emphasizes the fact that factors of several years ago are still pertinent. Over five years ago two multi-engine aircraft collided over a brightly lighted city on a clear night with a loss of 49 lives. The cause: neither aircrew saw the other aircraft in time to avoid a collision. Sobering is the thought that this same type accident could be repeated tonight. Both aircraft types are still flying, with no more effective anti-collision devices than they had then. Minor improvements in traffic control that would tend to prevent a repeat of this accident are probably offset by the fact that, due to population increases, there are more distracting lights from the city now than there were at the time the accident happened.

In another accident, a head-on collision involving a jet fighter and a jet trainer, rate of closure was 1326 feet per second. Recalling Dr. Zeller's perception-decision-response cycle, detection distance would have had to be greater than three miles for a *possibility* of preventing the collision. Considering the head-on profile of a T-Bird, there is some doubt that the pilots could have seen each other, even had they no other task than



The accompanying photographs show damage to the tail section of an Air Force tanker that had been involved in a midair collision with a receiver aircraft during inflight refueling operations.

scanning and had they known where to look. In other words, accidents such as this might well be considered inevitable, and might still be considered so until better avoidance systems are available and in use.

Sometimes even greatly reduced closure rates, do not prevent accidents. Recently, collisions occurred, although pilots of both aircraft knew of the other's existence and approximate direction and were, in fact, positioning for a formation join-up.

Another midair occurred when two large aircraft were on a special mission which required formation flying during part of the mission. The pilot of one aircraft apparently allowed his plane to turn into the other aircraft.

In an accident in which a wingman collided with his leader, the wingman had diverted his attention to observe an airliner.

After rolling out of a turn to place a fighter aircraft on a 90 degree angle to the initial a collision occurred with another aircraft. Pilots of both aircraft involved failed to see the other aircraft at any time. A study made by the command concerned disclosed that possibility of an accident such as this is not so remote when it is noted that:

Ninety per cent of all collision accidents occur in VFR conditions.

Twenty per cent of all collisions occur within five miles of an airfield.

Jets are involved five times more often than non-jets.

Forty per cent of all near misses occur below 5000 feet.

Pilots' visual perception-reaction is inadequate.

Except for the all-jet aspect, the above precepts were applicable in a later accident involving a jet fighter and a light aircraft. A recommendation following this accident was that restricted areas be established in corridors through which jet fighters must regularly fly.

As could be expected, a high percentage of the Air Force collision accidents occur in associated type operations such as refuelings, intercepts and formation flying. In one such case the receiver underran the tanker and both the boom operator and the crew of the receiver lost sight of the other aircraft. As a result of the accident that resulted when the two aircraft subsequently collided, the recommendation was made that a mandatory breakaway maneuver be executed when ever the receiver is within one-half mile of the tanker and the receiver pilot, copilot or tanker boom operator loses visual contact with the other aircraft.

During a night formation flight clouds were entered and the aircraft could no longer safely remain in formation. Number two and the lead aircraft collided when lead made a turn. Following this accident recommendations were:

Flying safety is paramount in formation flying.

Immediate reaction procedures should be devised to provide for emergency actions when unexpected weather conditions are encountered.

Consideration should be given to making night formation weather conditions more stringent than other VFR minimums.

Radio discipline should be redefined to clarify the point that radio discipline does not mean radio silence when communications will enhance the safe completion of a training mission.

Formation leaders must not make excessively fast or steep maneuvers to tax the ability of wingmen and succeeding elements.

Here's an example that points up the fact that at no time can a pilot relax his vigilance. Two T-33s had completed the formation phase of their mission uneventfully. The formation terminated when lead pitched out on initial. The number two man made his pitch too soon, then made his turn too tight and, after about 45 degrees of turn and upon a warning by the rear seat pilot in the Nr 2 aircraft, evasive action was attempted. A tip tank was knocked from each aircraft in this collision, but both aircraft landed without further incident.

Tomorrow's Trouble continued

The above briefs are presented solely to illustrate the variety of midair collision possibilities. In the omni-dimensional environment of airspace there is an infinite number of directions from which two aircraft can approach each other and collide. The triple problem of discerning, evaluating and evading is almost as complex as these potential collision angles in airspace. There are some situations in which, as Dr. Zeller and others have stated, the pilot finds himself in a situation which exceeds the capability of the man and the machine as presently constituted. To make midair collisions potentially preventable requires that better information be supplied to the pilot along with control procedures which positively guarantee aircraft separation.

These aids are not going to be available for tomorrow's flight. But to help the pilot do a better job with what he has (hindsight indicates that many past midair collision accidents would not have happened with better air discipline and common sense) the following suggestions are made:

FORMATION FLYING

Be briefed, know the route, anticipate turns, slow downs and never fly tighter, or looser, than specified in the manuals. Never bank your aircraft to the extent that visual contact is lost with your leader during join-up. Avoid prop or jet wash whenever possible, especially on takeoff and landing. Remember, aileron alone has little effect in prop or jet wash; use rudder and aileron together if ever caught in the wash. When landing adhere to the time interval. Think of the man behind. Take the side of the runway you are supposed to, never the middle. Watch for an abort by the man ahead during takeoff. Know each aircraft's call sign and position. When leading a formation remember these hints: Use minimum amounts of bank. Fly smoothly. Make no abrupt control or power changes. Use proper signals for gear, speed brakes, afterburner, peel off, etc., and give your wingmen and element leaders time to receive and understand all signals. Think ahead of your formation. Never take a formation into areas of poor visibility, low ceilings and turbulence. For large formations, send a weather ship ahead, if weather is forecast to be marginal. Know the limitations of the pilots in your formation. Adhere to altitudes and airspeeds. Fly slightly above or slightly below, not level with your leader.

The single overriding safety requisite of a good formation is a *good formation lead*.

NON-FORMATION

Look around, getting hit by another aircraft can be every bit as deadly as being hit by a bullet in aerial combat.

Use the autopilot during climb and descent to permit more scanning time.

Every ride isn't an instrument check. Airplanes won't stall if flown in a plus or minus 10- to 15-knot-range from best climb or penetration speed. A stall buffet is not as hazardous as a midair collision.

Don't fly exact pattern altitudes at the expense of scanning for other aircraft. Plus or minus 100 feet is not as dangerous as failing to see one of general aviation's bug smashers.

Insist upon scanning by other crewmembers, particularly in highly congested areas.

Listen—a lot can be learned by what others say on the radio—"turning downwind, five out on GCA, initial with four, going around, estimating the omni at four six, one-four thousand, extending downwind, making a three-sixty" . . . each such phrase tells you something about the present and projected location of another aircraft.

Use radar advisory service. Ground controllers won't spot all the aircraft, and they will often spot aircraft well above or below you, but on occasion they spot aircraft headed toward you at your altitude.

Keep cockpit lights low at night for better outside viewing. Be particularly alert when flying over brightly lit cities, on brilliant, clear, star-studded nights. Use night curtains.

Don't use the glare shield as a catch all for maps, flight plans, pipes, flashlights, paper cups, flight lunches, computors, letdown plates, manifests, the Form 781—they block the view, cause reflections and besides, candy bars placed there will melt from the heat.

In bright sunlight use sunglasses or the visor.

If VFR, and visibility is marginal, refile IFR hard altitude—you will still have to look around, but you get better protection from other IFR traffic. In fact, it is safer to always file IFR, safest of all to file IFR and fly in continuous cloud.

Make turns while climbing and descending.

When avoidable, never climb or let down into conflicting traffic, e.g., enter the entry leg from the side and level, not the opposite direction above.

Make instrument approaches, even practice instrument approaches whenever possible — let the GCA eyes help you scan.

Leave altitudes when you report leaving them, not a half-minute or minute later.

Expedite penetrations and let downs, the sooner you get on the ground the sooner you cease to be a collision hazard.

When doing air work select an off-airway area.

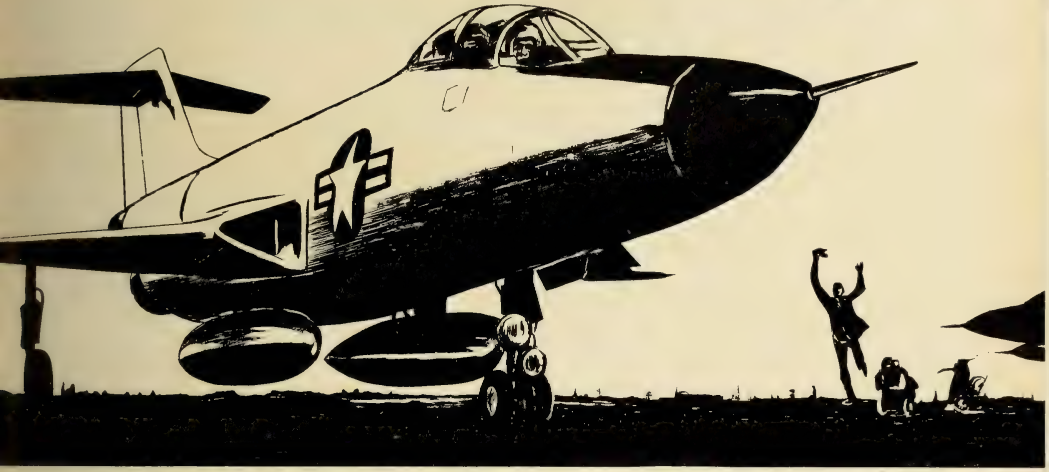
Beware the speck that doesn't move, or stops moving —those are the planes that can hit you.

CONCLUSION

The plain facts are that the man who flys tonight, or tomorrow, faces as great a mid-air collision threat as he did five or more years ago, despite widespread concern over the hazards and the many proposals that have been advanced to decrease such hazards.

To be brutally realistic, the man who flys must accept the fact that collision avoidance is still primarily a problem of see and be seen. His best anti-collision device—though it was surely not initially designed to perceive dangers that approach at bulletlike speeds—is still that pair of eyeballs that are no better, if as good, as the pair his ancestors had when max convergence speed was limited to how fast two Neanderthals could run. ☆

for want of a warning



When the F-101 taxied away a pool of hydraulic fluid marked the spot where it had been parked. That wasn't what caught the crew chief's eye; it was the stream of fluid dripping from the taxiing plane. He tried to catch the attention of the crew. But no yell can carry above the whine of two J-57's. And neither pilot saw his frantic gestures. The mission was a practice scramble from the maintenance area. On a scramble it's a race against time. There are no seconds to waste looking around. All preflight checks had to be made in the three to four thousand feet of taxiway. By the time the runway is reached it's into burner and GO!

The crewchief ran to the nearest communications vehicle and called Maintenance Control. "The One Oh One that just scrambled from the maintenance area—stop him—he's got a hydraulic leak."

Maintenance Control had no direct frequency link with aircraft. But they did have a channel to call tower. They relayed the crew chief's message.

The Mobile Control officer, a pilot himself and trained to watch for any sign of malfunction would surely have caught it, but for one thing: he was located at the opposite end of the runway. Remember, this was a practice scramble. The wind was light enough to permit a takeoff toward mobile. This was the shortest taxi route from the maintenance area—more seconds saved.

By the time the tower controller had the message he no longer had direct radio communication. Scrambles have priority. The 101 had reached the active, been cleared to Departure Control and for immediate takeoff.

The tower controller, trained for quick reaction, still had time. The 101 was just starting his takeoff roll. This was now an emergency and the controller called the aircraft on Guard channel.

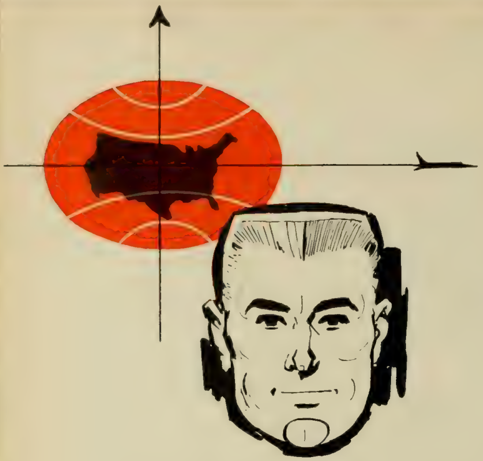
This call, in the nick of time, would have done it, would have except for one thing. The pilots in the 101, even as they heard the near simultaneous sound and felt the jolt as the two A/B's cut in, were cheated of their last warning. The transmission that came through their headsets was garbled. At the same time that the tower controller tried desperately to warn them of the hydraulic leak, Departure Control used Guard channel to transmit to an airborne aircraft.

The tower operator watched as the 101 accelerated rapidly. Why didn't he abort? The nose came up. Quickly the tower operator repeated his message. This time it got through.

For the first time the crew of the 101 learned of their hydraulic leak. Too late, they were airborne now.

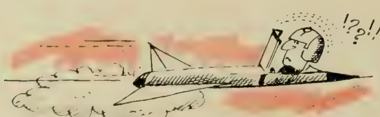
As the plane swept up in a climbing turn the hydraulically boosted control system went out. They had no choice. Eject!

Fortunately, the two pilots ejected successfully. But a first line fighter was destroyed. Destroyed because of a hydraulic leak, a blocked Guard transmsision, and a matter of seconds. ☆



Rex Riley's
CROSS COU

SAME SONG, 'NOTHER CHORUS. Or we might title this one, "the horse THEN the cart." Rex shakes his head, but he vows to keep on reporting these. True, most have been worked into the "minor" or the "incident" category, but they still smack loudly of non-professionalism. In this one the T-Bird jock had applied power to continue his touch-and-go and checked all instruments normal and full power available. The IP followed through on the power application and noted full power available. In the process of checking his instruments the pilot stated that he saw that the airspeed was 125 KIAS, which he knew to be the minimum gear retraction speed. At that point, he automatically retracted the gear although he had not yet applied back pressure on the stick. A fairly predictable sequence of events ensued. The nose gear retracted. This allowed the nose to contact the runway. And then the main gear retracted, first the right, then the left. The throttle was stopcocked, the canopy raised and the crew evacuated without incident or injury. Damage to the aircraft was described as "very light."



CANOPY CAPERS. Prior to taxiing out for a night takeoff, the F-105 pilot closed the canopy, but did not lock it. He missed the canopy closed and locked check during the pre-takeoff check and didn't catch the warning light among the numerous red lights in the cockpit. After takeoff roll was started, and at a point after takeoff was committed, the pilot heard the noise as the canopy began to rise slightly. The canopy stopped after approximately one and one-half inches of travel. The aircraft was now at 270 knots. When airspeed was decreased to 230 knots, the canopy remained approximately one-half inch open, no vibration. The pilot burned fuel down to landing weight and landed uneventfully. A T.O. change is to authorize moving the red canopy warning light from the left console to the caution panel.

TOPPING THIS was the F-102 jock who, during climbout, airspeed 320, noticed an air disturbance around the canopy seal, the canopy creeping open, and a warning light on. He slowed down, but the canopy began to rise. He grabbed the canopy pull down handles but had to let go as the rising canopy began to pull him up. The canopy went to the full open position at 200 knots, 14,000 feet. The pilot declared an emergency. Aircraft control was satisfactory except for a slight yawing tendency to the right. Noise level was high, but the radio could still be used. A straight in, GCA assisted approach was made with the canopy full open on touchdown and roll out. Just in case, pilots of the unit involved have been rebriefed on the importance of insuring the canopy handle is fully engaged and locked prior to takeoff.

FIRE!
FIRE!
FIRE!
FIRE!
FIRE!
FIRE!
FIRE!
FIRE!
FIRE!
FIRE!

FIRE WARNING SYSTEM—One of the things that gets Rex all shook up is a malfunction of a fire warning system. They've been giving trouble for years, but here's a couple of pretty serious cases that deserve note.

A C-130E was on the way from Christchurch, N.Z., to Antarctica when the fire warning for Nr 4 came on. It was caged but the warning persisted, so the crew used the fire extinguishing sytem. They still had a fire indication in the cockpit although a scan of the engine showed no evidence of fire. The aircraft returned to Christchurch after a total flight of nearly eight hours. There, the fire warning was found to be false. Okay, that's what the crew expected. But it was also found that the fire extinguisher failed to discharge even though the activating squib had fired. What if there had been a fire?

Here's another case that cost 60 manhours of labor as well as a bucket of pilot sweat. The pilot of a T-Bird was getting a proficiency check when the little red light came on and stayed on. Power was gradually reduced to idle but the light continued to burn so the crew decided to shut down. They declared an emergency, kept checking for smoke or fumes, detected none, and headed for home. On final they got the engine started and left it in idle. A check of the warning

RY NOTES

circuit showed that the bulbs were good but that the test circuit did not operate. Again, they shut down and made a landing.

Electricians found a broken wire at the 5 o'clock temperature sensing bulb which they replaced and the bird ground checked okay. On the next takeoff, about 800 feet after brake release, the old red eye again stared at the pilot in an unblinking manner. He aborted and at about 45 knots the light went out. This time two pieces of safety wire and wire clip were found behind the front instrument panel near the test circuit wiring. A metal jacket on the communications cable was touching the wire for the fire warning and overheat circuit. This circuit was rerouted and the engine removed and placed on a test stand. The temperature sensing bulb at the 5 o'clock position as again found loose as was the wiring. Wiring and bulb were replaced.

The last Rex heard on this one was that the aircraft was awaiting test flight. Wonder if anything else was wrong?

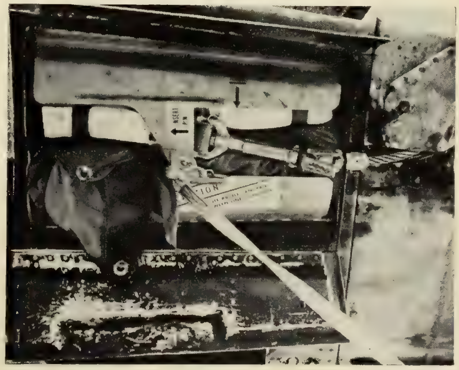
A LESSON IN ADDITION. Plans for the heavyweight takeoff were completed. Rolling takeoff was initiated. Acceleration speed check was above minimum. Acceleration appeared to hang briefly at 160 knots, then increased to rotation speed and lift off speed. Several witnesses estimated lift off came about 700 feet from the end. The main gear appeared to be approximately two feet above the surface of the overrun and skimmed the perimeter road.

Subsequent investigation of this incident accounted for 1150 feet more ground roll than computed. Here's how:

Wind direction indicators were found to be 43 degrees out of phase, thus the aircraft took off with a three knot tail wind factor. This accounted for 650 feet. The point at which the rolling takeoff leadin line intersects the runway took care of another 300 feet. The two-tenths of one per cent runway gradient, not figured in computing takeoff ground roll requirements, added the other 200 feet.

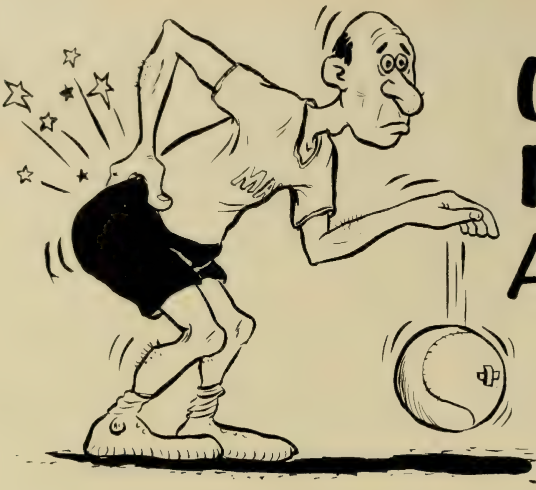
Fortunately, exacting mission requirements such as these are performed by top professionals, who quickly took action required to minimize the hazard. Rex isn't so concerned about these first line troops as he is about the proficiency types who might occasionally need accurate takeoff performance information at a high elevation, hot day field. Accident files disclose that trouble can be encountered even in some of the more ancient birds when takeoff performance information is not accurate.

OVERBOOSTS AND OVERTEMPS. A few years back, and still today for recip drivers, the hazards of overboosting were frequently a subject at safety meetings. Overboosting was an insidious danger as it didn't necessarily cause immediate engine failure, but was more likely to weaken the engine so that it would fail subsequently, most probably during a time of high power demand. Now, a similar situation exists due to jet engine overtemps. Not long ago an F-100, in full military and passing through 2000 after takeoff, experienced a loss of thrust. The jock eased back to 85 per cent as he noted the EGT going through 700 degrees. He declared an emergency and made a precautionary landing. After landing and during taxi-in no increase in RPM was noted as the throttle was advanced. The aircraft was shut down and towed off the runway. Investigation disclosed all blades of the second and third stage turbine wheels had failed approximately one and one-half inches from the tip due to an apparent overtemperature condition. All blades were twisted or buckled and burned. Rex asks all to remember, the reporting of an overtemp is not nearly as drastic as non-reporting and possibly costing a buddy's life.



How NOT to install a drag chute on the F-100. The misrouting of the pilot chute bridle shown on this "transient F-100" is graphic evidence of improper installation and identical to an error noted on another transient aircraft. This common malpractice has caused so many failures in drag chute deployment, Rex has suggested this photo also be shown to maintenance personnel.

Capt Glen R. Wilson, Flying Safety Div, Kelly AFB, Tex.



OH MY ACHIN'...

Most thinking about an accident is immediately thereafter . . . .

"Bill, Bill, over here!" he yelled, breaking into the open on the base gym basketball court. He cut left, trying to stay in the clear as feet pounded closer behind him. He dodged right, left again, then abruptly stopped. Instantly he felt the excruciating pain when the foot of his pursuer came down on his heel. He hobbled to the side of the court, crumpled on a bleacher and began, gently, to massage his injured ankle. His injury broke up the impromptu game. His friends gathered around, awkward in their helplessness as he grimaced in pain. They helped him to a car and took him to the hospital. There a doctor examined the injury, determined that the Achilles' tendon had been torn and prescribed treatment. For three days the lieutenant came to the hospital for treatment. Later in the month he had to be admitted for corrective surgery. His hospitalization lasted three months.

Unusual? Not really. This sort of thing happens every day in the Air Force. It all comes under the heading of sports and recreation accidents.

What do you care? Not much, really. We don't expect the average reader to be impressed by the fact that such accidents cost the Air Force $8,000 a day, or that they account for 25,000 lost man days a year.

These are rather nebulous things like "millions" and "close supervision" and "reemphasis of inherent hazards" and "reports."

If you had watched your friend's contorted face as he weathered the pain of a torn Achilles' tendon you would have been much more impressed. About the only thing that would make a greater impression would be to have a 200 pound basketball player come down, full force, on your heel.

That would really impress you.

Imagine how this one must have smarted. It was New Year's. An airman, accompanied by two buddies, engaged in a recreational activity known by various terms, including bar-hopping. After several stops, and at about 2230, they decided to stop at a cafe to sober up before returning to the base. One airman decided to go to the rest room. The airman who becomes the central character in this case decided to follow. There was a door. When the first airman went through it and the door swung shut, the second airman doubled his fist and struck the door. Later that same evening the door-striking airman reported to the hospital. His hand was put in a cast and toward the end of the month surgery was performed on his hand.

For anyone inclined to tipple on occasion this one "accident" is more impressive than mere knowledge that a part of the $8,000 per day cost is due to making out of the Form 711's, endorsing same, counseling the suffering, sending copies to Norton where girls tabulate and file and Ground Safety specialists strive to do something effective about this three million-plus-per-year problem.

There are many ways this pain-in-sports business can be treated. How about by selected parts of the anatomy? Easy. The knee. The captain and his friends arrived at the snow lodge, decided to try the toboggan slide. The captain sat in front and a friend behind on the first (his last) run. When the toboggan hit an unusually large bump his left leg flew off the toboggan. His foot caught in the snow but the rest of him tried to continue on. Initially the pain was almost unbearable, or so it seeemed. By the time he reached the hospital he had become more used to it. Among other things, he was given crutches and physical therapy for three days. Satisfactory recovery did not result and ten days later he entered the hospital for knee surgery.

Every once in a while the Records and Statistics types and the Sports and Recreations specialists combine their talents and come up with things like stat run breakdowns, pie charts, and other cataloging techniques. Ultimate disposition of such efforts is made, usually, to interested parties, like commanders and safety officers. A while back they revealed that for 10 months of 1962 and the first 10 months of 1963 a total of 4,737 Air Force personnel experienced such injuries. (Purists might nit-pick this statement, so we admit that the small minority of these might have been reoccurrences during the period of this report. In fact, one airman, a roller skating rink injury repeater, admitted to "one or two falls each two hour skating period.")

Sometimes, even with reasonable precautions, injuries ensue. Here's one. After three hours of classes a lieutenant reported to the athletic field for a game of touch football. (The three hours of classes has no apparent tie in, but it was in the report and we hesitate to take the editorial liberty of omission.) The game was part of a supervised Physical Development and Conditioning Course and was under the supervision of a Military Training Officer. After approximately one hour the lieutenant had to take himself out of the game because of severe pain that had developed in a knee. There had been no horse play, the game had been well supervised and the sufferer could not recall exactly when or what had caused the injury. He was taken to the hospital and admitted with a torn cartilage. Subsequent investigation disclosed that someone had recently planted a tree on the playing field and had dug a hole around the base of this tree. The lieutenant had stepped in this hole, which caused him to fall, and he had twisted his knee as he had fallen.

Another breakout made of the 20 month statistics reported above was contact vs. non-contact sports. It came out this way: non-contact 3045; contact 836. The 856 left over were attributed to recreation. This takes in such things as the airman who tried to ram his fist through the latrine door and people falling down the steps even before they had given themselves a chance to pull back muscles heaving heavy balls down slick bowling alleys. Oh yes, before these figures get stomped on—they are totals; there is more inherent hazard in contact than non-contact, but there is considerably less of the former than the latter.

A cause factor that crops up once in a while is "exceeding individual physical limitations." This is followed by the recommended corrective action, "counseled to not exceed physical limitations." One medical type put the kiss of death on this routine with an additional endorsement to the effect that the normal means of determining physical limitations is by exceeding same.

Some accidents, in retrospect, seem almost as if the individual deserved what he got—just too bad the Air Force has to pay the bill and lose the man days: the major who decided to debark from the motor boat by first standing on a wobbly bench in the boat. He fell. . . . Or the captain who cut the end of his finger off with a power saw.

Once in a while, in leafing through the seemingly endless stacks of Form 711's there comes to light a real gem, or it would have been had not someone suffered pain and loss of productive man days to make it possible. In this category is the case of the alarm clock, the failure of which is listed as a contributing cause. In this case the individual received first degree thermal burns when he fell asleep under a sun lamp. He reported that he had set his alarm clock for thirty minutes, but that the clock had run ten minutes and stopped.

Love, even in its early stages, can be hazardous. An airman taking a moonlight stroll with his girl stepped on a rock, twisted his ankle. The moral, in essence, never become so enamored that you fail to watch your step.

A lot of accidents stand to reason. People are more likely to run into chairs if they come inside from bright sunlight. More are injured on stairs when running or taking steps two at a time than when walking and taking steps one at a time. More falls occur when it is wet than dry; more yet when there is snow and ice. A person is more likely to injure himself if he jumps off a porch than if he walks down the steps.

To wind this up, let's get to the big question—what can be done to reduce the number of sports and recreation injuries?

Here are some suggestions, picked at random, from a few of the many Form 711's the Air Force fills out.

Warm up before participating in sports activities.

There are hazards of exuberance.

Horseplay is dangerous.

Those who don't look where they are going are liable to get hurt.

Don't hurry.

Use proper safety equipment for the sport you engage in.

Momentary lapses in attention lead to accidents.

Playing in unauthorized areas is hazardous.

There are holes along walks, around steps, in driveways.

Use the buddy system.

Most important, all the protective sports equipment made isn't as good as the habit of Common Sense!

Read these again. Think about them this time. They make sense. ☆

Do Unto Others . . .

Previous articles in this series on search and rescue stressed what the individual can do to help ensure his survival and rescue. In this, the last of the series, the other side of the coin is examined: the fundamentals of conducting a search and rescue operation.

John L. Vandegrift, Hq Air Rescue Service, Orlando AFB, Fla

You can hardly beat the Boy Scout slogan, "Be Prepared." It sums up the philosophy behind the first two articles of this series ("Get the Word Out," AEROSPACE SAFETY, July 1964, and "Help Rescue Help You," AEROSPACE SAFETY, August 1964) and it pertains equally to this third and last article of the series only here we'll look at the other side of the coin. The first two articles concerned themselves with helping you cash in on your old age benefits; this one considers the other guy.

You'll never know when you may be called in to assist in a search mission. Therefore, a thorough knowledge of search procedures is important to all Air Force personnel and others who may become involved in such endeavors. After all, the life you save may be your buddy's—and vice versa. Consequently, "Do unto others as you would have them do unto you." For this admirable reason it behooves all who wear the Air Force blue to know at least the rudiments of running a search mission.

First of all, should you be tagged with one of these assignments, familiarization with all aspects of search and rescue is a basic requirement. The area Rescue Coordination Center, or its SAR Mission Coordinator will provide a briefing of all the known facts, and you, as acting SAR Mission Coordinator, will plan a course of action to best achieve the overall objective. No two missions are alike but there are certain ground rules.

Determine whether you can control and direct a search effort from your present location. Are adequate facilities and communications available? It is highly desirable to be as near as possible to the "area of highest probability" so that there will be close contact with the search operation. From this location you will brief and debrief the search crews, pass information on progress and leads to the Rescue Center, consolidate reports, plan future operations, and, in general, remain on top of the mission.

Appoint as many assistant SAR Mission Coordinators as are needed, and designate an on-scene commander to direct operations in the immediate search area. Careful study of the terrain to be searched, size of area involved, leads to be investigated, and distance from base of operations will help you determine what forces are required. Mobile ground interrogation units are of major importance in checking out leads, and CAP units have done highly commendable work in this area. While repetition is to be avoided as time-consuming, when there's any doubt recheck communications reports and airport ramps early in the game. It may eliminate unnecessary searches.

If you have been assigned a search mission late in the day or at night, alert forces immediately; don't wait until morning. Have crews, teams, and aircraft ready to go at first light, or valuable search time will be lost. Speed is essential in recovery of survivors. Establish a mission control facility and provide a room or adjacent rooms large enough to conduct crew briefings, lay out plotting boards and status charts, and set up mobile radio gear and other communications equipment. To consolidate briefing, debriefing, assignment of search areas, plan future operations and maintain overall control it is highly desirable to have all search crews working out of one location.

One of the most important aspects of any SAR mission is the proper use of news media to enhance and intensify search activity. In fact, on a National SAR Plan type mission the proper use of news media personnel can make or break the entire mission effort. Newspaper stories, radio and TV bulletins are an excellent source of leads from persons who may have observed occurrences related to the mission. The importance of the leads thus generated cannot be overemphasized. Wherever possible the services of information officers should be utilized and in any case the guidelines for releasing public information as prescribed in the Air Force AFR 190 series, Appendix B, AFM 64-2, and ARSM 55-1 will pertain. Request that the nearest military base commander provide information personnel to handle this phase of the operation.

Personnel assigned to this phase should stick to the mission coordinator like glue and keep news media representatives as up-to-date as possible on each new aspect of the mission as it develops. The mission coordinator cannot possibly have the time to do the information job properly and at the end of any mission, if the information personnel have been pulling their weight in the boat, they should be just as pooped as the mission coordinator. Handled properly, news media relations can involve the entire community in helping you locate the mission objective. This area, too often neglected, may pay the biggest dividends.

Consolidate, evaluate, and act upon the rumors and leads you will almost certainly receive. Although many will seem unrealistic, you cannot afford not to check them out. Leads will frequently form a pattern in an area; concentrate your efforts here, but don't abandon all search efforts along the route until you're sure. Logic is great but records show that people will occasionally turn up in the craziest places. "Wrong Way" Corrigan did not receive an exclusive patent.

Search crews will frequently arrive with limited, exaggerated or erroneous information concerning the objective. Brief them thoroughly before they start out and periodically thereafter as necessary. Impress on them the importance of their mission; a dedicated and well informed person is twice as effective as one who's just along for the ride. Don't let them think you are becoming discouraged, or that the mission is hopeless—ever. This is a normal reaction after two or three days of intensive, unproductive efforts but too often the troops tend to give up too easily. Stress flying safety and ground safety measures. You have problems enough and don't need another incident on your hands. It is easy for searchers to become injured or lost through carelessness. Personnel must be briefed on all facets of conducting a search including search procedures, scanning procedures, what to look for, what to report, and to whom.

The necessity for accurate reporting must be strongly stressed.

If additional forces are required to carry out the mission adequately, contact the area Rescue Coordination Center (RCC). The men in the Center know where forces are available and will get them for you. The supporting forces will be alerted and turned over to you for operational control.

You will be responsible for compiling a daily progress report based on search area coverage, thoroughness of search, estimate of search effectiveness, leads, sightings, hours and sorties expended, availability of forces for next day's search, and any other pertinent data. A daily telephonic report should be made to the RCC prior to 2200 L with the above information.

Plans for your next day's search should be included in your daily progress report. This is essential so that the SAR Coordinator at the RCC may discuss them with you. He can provide professional assistance, and since he has overall responsibility, he must concur in your actions. Call the RCC whenever there is a major development or a find; the center must remain current to answer inquiries of press, relatives, and higher commands. Here again, the info types can come in handy getting the word out to the ever curious American public.

Maintain an operations log of all pertinent activities during the progress of the mission. This will aid you and the guy who'll relieve you in keeping up-to-date, will assist you in accomplishing your reports, and will be a permanent record for future review of the mission.

In the preliminary search, it is desirable to cover rapidly all the territory in which the aircraft could have crashed. Route search, to include checks of the highest terrain, frozen lakes, stream beds, possible forced landing area, and sightings of smoke or fire, is normally used in this phase. At night, a sweep by any available aircraft—even jet—may reveal fires set by a crash or get a signal on 243.0 mc from a URC-10 or 11 or the new Personnel Locator Beacon (URT-21).

Initial search should cover an area ten miles each side of the center line of the proposed route. If the results of this coverage are negative, expand the search area upon either side of the route, based on past winds, weather and any other pertinent factors.

Failure to achieve positive results with the above procedure should lead to the establishment of designated search areas, based on your judgment as to the area of highest probability. Search patterns to be conducted within these areas fall into five general categories, as determined by conditions existing at the time.

A *parallel track* pattern is generally selected when the search area is large and relatively level. It is especially adaptable to rectangular areas where the object of search is expected to be somewhere between two points and possibly off track due to navigational error or surface drift.

The *creeping line* search is similar to the above, and consists of successive sweeps along a given track, flown at right angles to the course. It is for use when survivors or distressed units are reported between two points along a given tract.

Do Unto Others . . . continued

The *contour* search is used to search mountainous or hilly terrain. Contour search areas should be assigned to conform to either natural or manmade boundaries, such as rivers, roads, railroads, etc. Aerial search of mountains is more hazardous than search of level terrain, and requires skill, judgment and proficiency to be conducted safely.

The *expanding square* pattern is used when the approximate position of the SAR objective is known and the area to be searched is not extensive. It is started at the most probable position of the search objective and expanded outward with a square pattern.

The *sector* search is used also when the position of distress is fairly well established and the area to be searched is not extensive. It consists of a pattern of radii extending from the center point.

All of the above patterns, and variations thereof, are described in detail in SAR manuals. Care should be taken to assign search areas and patterns based upon the experience of the crews, type aircraft, terrain, weather conditions, and radio capability. If you are concentrating aircraft in an area, or if the search areas overlap, assign search altitudes. A 500-foot minimum separation is desirable.

Use ground mobile interrogation teams to the utmost in checking the authenticity of leads. They can save you much time and effort in air search. If possible they should be equipped with radios for expeditious relay of information, and can be used to check out air sightings.

Concentrated search in areas of dense underbrush may be feasible by ground parties on foot or on horseback. You should be lining up such personnel early in the search so they will be available when needed. In nearly all cases some sort of small ground party will be required when the SAR objective is sighted.

Insure that positive identification of wreckage is made. If this is not possible by air surveillance, dispatch a ground party immediately. Coordinate your actions with the nearest sheriff, state police, or military installation for identification of personnel.

Attempt to obtain trained medical personnel before evacuating injured survivors. Don't move the dead unless a military doctor or civilian coroner is present.

Mark the wreckage before abandoning the scene if it's in an inaccessible area where removal appears impractical. Air Force regulations outline the procedures and markings. Include this information in your closing report to the RCC so they can plot and establish it on their wreckage locator board.

In this series of articles we have attempted to familiarize Air Force personnel with the various phases of search and rescue activities, plus making the individual aware of his responsibility in the effort to insure his survival. At the onset, persons involved in an emergency should make every effort to alert Rescue forces as early as possible of any actual or probable situation which might require their assistance. If disaster occurs, they should follow the suggested procedures to the best of their ability to assist in their location and recovery. Finally, they should be aware of the time-tested procedures of the search mission commander or searcher.

Do your homework. In this way, each individual will stand to benefit to the maximum from the professional forces of Air Rescue Service, who seek to insure "That Others May Live." Remember, it can happen to you.

AVIATOR'S BASIC RULES FOR SURVIVAL

1. Prior to departure plan flight meticulously. This should include a thorough preflight check of aircraft.
2. File a flight plan with FAA or a responsible agency or person and follow it to the best of your ability.
3. Insure that there is adequate survival equipment aboard appropriate to the particular flight and that it is in good working order.
4. Wear clothing appropriate to the climate and area over which you intend to fly.
5. Notify the nearest communications facility immediately when an emergency arises or appears imminent. Give pertinent details and maintain contact if possible.
6. In the event of a crash, emergency landing, bailout, etc., regroup and remain in the vicinity of the aircraft wreckage. This increases the probability of detection and enhances your chances of survival.
7. Know your personal and equipment limitations and do not exceed them.
8. Arrange maximum signalling devices from natural resources and equipment and conserve them and your other survival materials.
9. Plan in advance how to effectively utilize your survival gear, natural materials and the aircraft wreckage to provide shelter, heat, sustenance and first aid.
10. Don't panic. Help is on the way. Take stock of your assets and follow a methodical plan of action to stay alive. As soon as conditions warrant, following the emergency, get busy and stay busy. ☆

FILMS:

SFP 1175a & b	**The SAR Mission Coordinator (soon to be released).**
SFP 1089	**That Others May Live**
SFP 330	**Help Available**
TF 1-5333	**Helicopter Rescue Operations**
SFP 1039	**Search Operations**
SFP 1085	**The Air Rescue Service**
TF 1-4968	**Know Your ARS**
TF 1-5054	**Visual Aspects of Search and Signalling**
TF 1-5309	**Stay Alive in the Winter Arctic**
TF 1-5310	**Stay Alive in the Winter Bush**
14C/3525	**Search and Rescue — Search Areas (RCAF)**
14C/3526	**Search and Rescue — Search Operations (RCAF)**

PUBLICATIONS:

National Search and Rescue Manual, AFM 64-2
Inland SAR Plan, ARS OPLAN 506
Survival Training, AFM 64-3
Aircraft Emergency Procedures Over Water, AFM 64-6
Rescue Operations Manual, ARSM 55-1

Taken for Granted

Maj George H. Tully, Hq Air Force Communications Services
Scott Air Force Base, Illinois

How long have you been flying? The answers to that question by you avid readers of flight safety publications will range from one year to perhaps 30 years. The experience you have accumulated during your years of rated service is an item of pride and satisfaction which you keep stashed away in your hip pocket. Let's take a look at a strong contributor to your safe accomplishment of flight experience.

It's 0700 Monday. You've reported to flight planning as scheduled. The routine of preparing for an 0900 wheels up takeoff with your C-118, T-33, U-3, or whatever, is proceeding smoothly. Finally, planning and preflight completed, crew briefed, you fire up and depress your mike button.

"Hopedale ground control 39439 taxi, over."

And Hopedale comes back with, "39439, taxi runway 30, etc. . . ."

Without further ado, with confidence in the instructions you received, you taxi out and follow the appropriate route. After a few more transmissions to and from ground control, your turnover to departure control frequency is accomplished.

You say, "39439 ready for takeoff."

"Roger, 39439, left turn after takeoff. Contact departure control on 394.2. Squawk 3, code 10 normal."

Off you go, confident in your actions and confident in the instructions you received, dedicated to immediate response to the directions these voices give you.

The flight continues, passed from one control agency to another. Voices change but your confidence doesn't. A check with METRO 70 miles from destination throws a slight curve at your well being. Destination is reporting 200 feet, 1½ miles, light rain. It's been a while since your last near minimums approach. Yet, you know you can fly your bird as well as the next guy and you've got confidence in this or any other approach facility.

"Roger, Willow approach, descending to 3000 feet, heading 080."

Enroute descent has commenced. Radar identification has been established and reported to you by the facility. Gets easier all the time, doesn't it? They've identified your aircraft, given the position and provided control. Your confidence peaks again, the handoff from enroute to terminal facility is complete and in you come, chances are without further frequency changes until turned over to Willow ground control after touchdown. A quick stop in Ops, close the flight plan, a few words with Weather, and home to the family.

To a great degree, it's all been taken for granted. After your first depression of the mike button this morning until engine shutdown in the parking place, the handling of your aircraft by the air traffic control facilities has been taken for granted. You expect safe, efficient control and you get it. You converse with two to 20 voices, dependent on your flight plan length,—"voices in the dark"—voices that control your actions and the movements of your bird.

Who are these voices? They're no different from you or me. As a matter of fact the pressure on them is frequently as great or greater than the pressure on you. Yet, they're trained to appreciate your position and your need as you thread your way through the ATC network. You don't need to tell them that you're exposed to hazardous happenings if they make any mistakes. They live with *that* responsibility. Controllers aren't born, they're made. Made by tough and rigid training and supervision. Made by experience and qualification, the same as you, the pilot. Their environment may be different from yours, but their life is much the same — responsibility, pressure, service.

For the most part, air traffic controllers don't hear much from pilots unless the pilots are unhappy and have a verbal or OHR type complaint. You've got the picture in your cockpit but not the big picture. Vice versa, the controller has the big picture (he has to) but not the cockpit picture. Discuss control problems with appropriate facilities when you can (on the ground, that is). You may have an idea or suggestion of interest to a watch supervisor, military or civilian. Don't forget, the confidence that you have in the facilities comes from *your* experience. ☆

FAA ADVISORIE

TWO-LAYER AIRWAY—Effective 0001 EST, September 17, the present three-layer airway route structure was revised to a simplified two-layer system. Also, as of this date, all aircraft operating at and above 18,000 feet msl are required to use the standard altimeter setting of 29.92 hg.

The two-layer route structure provides "Airways" up to 18,000 feet and "Jet Routes" between 18,000 and 45,000 feet. The airspace above 45,000 feet is available for random operations with no established airways or routes. Alaska and Hawaii are not affected by the change.

In the new system, altitudes 18,000 feet and above are referred to as flight levels.

Area Positive Control continues to be those altitudes from FL-240 to FL-600, therefore, pilots may continue to fly IFR, VFR on top to all altitudes to 23,500.

Positive Controlled Airways (17,000 to 22,000 feet) are non-existent.

To avoid conflict between aircraft at high altitudes (17,000 feet), and those at low flight levels (FL-180) when the atmospheric pressure drops below 29.92 hg, assignment of flight levels by air traffic controllers shall be determined from the following table based on current atmospheric pressure:

Pressure in Inches of Mercury	Lowest Usable Flight Levels
29.92 or higher	180
29.91 to 28.92	190
28.91 to 27.92	200

Where the MEA prescribed is at or above 18,000 feet msl and the atmospheric pressure is less than 29.92, the lowest flight level assigned shall be the MEA plus the number of feet specified in the following table:

Altimeter Setting	Adjustment Factor (feet)
29.92 or higher	None
29.91 to 29.42	500
29.41 to 28.92	1000
28.91 to 28.42	1500
28.41 to 27.92	2000

Air Traffic Control personnel shall keep informed of the atmospheric pressure existing to insure that altitude assignments meet the requirements stated in the above charts.

Radar beacon enroute codes are as follows:

Below 18,000 feet—Code 11
FL-180 to FL-230—Code 15
FL-240 and above—Code 21.

WHEW! THAT WAS CLOSE!—You say you've experienced a near midair collision recently? Yes, I realize you've been requested to answer numerous questions from Air Traffic Control. No, these questions were not asked to incriminate you—only to aid in the investigation to learn who was at fault. This could prove to be you or the other fellow, or Air Traffic Control. You see, the only method we have of completing an investigation is to ask questions. These are standard questions, parts of which must be answered by *everyone* who reports a near midair.

For clarification, let's look at the questions, just as they appear in the FAA Facility Operations Manual.

a. DATE AND TIME (GMT) OF INCIDENT.

b. LOCATION OF INCIDENT AND ALTITUDE.

c. IDENTIFICATION AND TYPE OF REPORTING AIRCRAFT, AIRCREW DESTINATION, NAME AND HOME BASE OF PILOT.

d. IDENTIFICATION AND TYPE OF OTHER AIRCRAFT (IF KNOWN), AIRCREW DESTINATION, NAME AND HOME BASE OF PILOT.

e. TYPE OF FLIGHT PLANS, STATION ALTIMETER SETTINGS USED AND WHETHER ALTIMETER CORRECTION APPLIED.

f. DETAILED WEATHER CONDITIONS AT FLIGHT ALTITUDE/LEVEL.

g. APPROXIMATE COURSES OF BOTH AIRCRAFT: INDICATE IF ONE OR BOTH AIRCRAFT WERE CLIMBING/DESCENDING.

h. REPORTED SEPARATION IN DISTANCE AT FIRST SIGHTING: PROXIMITY AT CLOSEST POINT HORIZONTALLY AND VERTICALLY: LENGTH OF TIME IN SIGHT PRIOR TO EVASIVE ACTION.

i. DEGREE OF EVASIVE ACTION TAKEN, IF ANY (FROM BOTH AIRCRAFT, IF POSSIBLE): INJURIES, IF ANY.

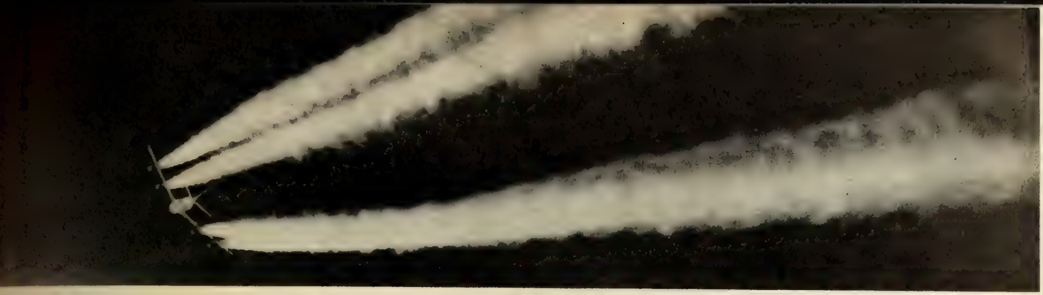
j. CLEARANCES ISSUED, IF PERTINENT. (This info normally provided by Air Traffic Control Facilities.)

k. NARRATIVE SUMMARY OF WHAT OCCURRED. (Provided by pilots at destination.)

As you can see, we ask some pretty pointed questions. Not only that, we require the controller to treat the incident with almost as much importance as he would an accident!

First of all, you, as a pilot, must determine if you really had a near midair collision. To determine this, you must ask yourself the following:

- Did I take abrupt evasive action?
- Was there structural damage to the aircraft and/or injuries to personnel? (Serious injury or fatality is also classed as an aircraft accident and must be reported as both an aircraft accident and a near midair collision.)
- As soon as you report the incident to the controller he must ask: "Are you reporting a near midair collision?"
- If your reply is affirmative, the appropriate information must be obtained as described above and a near midair collision report processed.



Bob Terneuzen, FAA Liaison Officer, Directorate of Aerospace Safety

One last point: Remember, if you are in VFR conditions, regardless of your flight plan (IFR or VFR), it is *your* responsibility to *look around*. Don't wait for the other guy to "make a move"; avoid getting into situations that can compromise you.

JET AND CONVENTIONAL CLIMB RESTRICTIONS—The FAA recently amended its controller's operations manual to reflect a change in the initial clearance handling of aircraft. As you may recall, it was sometimes difficult to understand how you could receive a jet clearance at, let's say flight level 310, and then, shortly after takeoff, receive an unplanned for, amended clearance restricting your flight to a low altitude for considerable distance. There were even times when you weren't sure just when you could expect a higher altitude!

Now Paragraph 231.5 of ATP 7110.1A states:

"Initial clearances issued to departing aircraft shall include:

A. Whenever practicable, the destination airport as the clearance limit, even though said airport may be outside of controlled airspace; and

B. Clearance at an altitude or flight level within the highest route structure filed by the pilot, or, if this is not feasible, information as to a specific time or fix at which clearance to such altitude or flight level may be expected.

NOTE: In the event of two-way radio communications failure, prior to receiving a specific altitude/flight level assignment within the highest route structure filed, control will be predicated on the fact that the pilot will begin climb to the expected further clearance altitude at the time or fix specified in the initial clearance."

Without a doubt, this procedure should clarify the bug-a-boo of what happens after takeoff relative to altitude assignment. Now you should have your climb restrictions clearly stated and in mind prior to departure.

The SID problem still remains status quo. Follow the printed climb restrictions of the SID—unless the original cruise altitude as received in your ATC clearance is amended. If this occurs, the controller must then restate *all* climb restrictions of the SID. Failure to do this negates the SID altitude restrictions.

The FAA is constantly striving to improve the Air Traffic Control situation in the ZI. So that you may share in their interest, I am listing a few of the major goals set for completion prior to 1968:

ENROUTE (ARTC)

- Sufficient automation of the control functions to eliminate control errors due to altitude, identification, posting and related duties.
- Positive control of all aircraft operating above 18,000 feet by the end of 1964.
- Stabilize center configuration to create a climate favorable for continuing improvements in the safety, quality and quantity of work accomplished per employee.
- Automation of the communication networks, both teletype and telephone.
- Sufficient reliable air/ground communciations capability to permit continuous operation of the ATC system during a national emergency.
- Develop and implement air traffic control procedures plus criteria to insure safety between aircraft operations and missile/rocket operations.

TERMINAL (TOWERS, RAPCONS)

- Sufficient automation at selected radar terminals to positively control or separate all traffic—VFR as well as IFR.
- Develop and implement a program to provide departing IFR pilots their complete ATC clearance prior to boarding their aircraft.
- Provide positive separation between all aircraft (IFR and VFR) operating in terminal areas.

There is a recognized need to provide pilots with complete weather information on a full-time basis, including thunderstorm activity observed on radar scopes. A method of solving this problem may be forthcoming in the near future.

The Flight Information Division of the FAA plans to publish and maintain the Airman's Information Manual as an improved operational replacement for the Airman's Guide and Flight Information Manual. ☆

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ARRESTS

Harrie D. Riley, Directorate of Aerospace Safety

This summary documents the 1963 record of aircraft contacts with the USAF Aircraft Arresting Barrier Systems. The barrier installations in operational use during the year consisted of the MA-1A for arresting non-hook equipped aircraft, a modified MA-1A barrier with a supported cable for arresting hook equipped aircraft, and the BAK/6 and BAK/9 cable barriers for arresting hook equipped aircraft.

During the period, 313 arresting barrier contacts occurred of which 276 or 88 per cent were successful. This was an increase of 4 per cent in the success rate of the USAF barrier operations relative to the previous year. The improvement was due to the increase in the number of contacts of hook equipped aircraft and the 98 per cent success rate for these engagements. In contrast the success rate of non-hook arrestment by the MA-1A barrier remained between the previously established 60 to 70 per cent rate.

Of the 37 unsuccessful contacts, 19 were at too slow a speed for engagement. This is a result of the design deficiency of the MA-1A barrier which requires a minimum airspeed for engagement of the main landing gear. Generally, failure to engage the barrier at too slow a speed did not result in any damage to the aircraft or injury to the aircrew and merely indicates the ineffectiveness of the MA-1A barrier for satisfactory arrestment at all airspeeds of non-hook equipped aircraft. There were five hook skips of BAK/6 or BAK/9 cables, three of which were unsuccessful. The MA-1 barrier, acting as a back-up, arrested two aircraft after the hook skips. One hook skip was attributed to a build-up of paint used for marking the runway centerline. Five unsuccessful engagements were the result of the MA-1 barrier being contacted by aircraft which had no compatibility with the barrier.

Materiel failures caused over 80 per cent of the barrier contacts. Drag chute failure was the most frequent offender. Failure of the drag chute to deploy, inadvertent jettisoning of the drag chute due to malfunction, and the failure of the chute to open properly accounted

STATISTICAL SUMMARY

Total Barrier Contacts	313
Successful	276
Unsuccessful	37
Causes for Unsuccessful Contacts Aircraft Speed Too Slow	19
External Stores or Speed Brakes Deflected Cable	2
Webbing Cut by Pitot Tube	2
Barrier Not Designed for Aircraft	5
Hook Skip (5 occurred; 2 successful by back-up barrier)	3
Other Causes (only 1 occurrence each cause)	6
Per Cent Successful — 1963 66%; 1962 84%; 1963 88%	37

BARRIER CONTACTS BY TYPE OF BARRIER

Type Barrier	Suc	Unsuc	Total	Per Cent Suc
MA-1 (Unmodified)	60	31	91	66
MA-1 (Modified, hook used)	27	0	27	100
BAK-6	46	1	47	98
BAK-9	143	5	148	97

BARRIER CONTACTS
CENTURY SERIES FIGHTERS VS OTHER AIRCRAFT

	Suc	Unsuc	Total	Per-Cent Suc
Century Series	220	17	237	93
Other Aircraft	56	20	76	74

for 40 per cent of the barrier contacts. Drag chute failures in conjunction with other conditions caused 32 barrier engagements. It is apparent that more adequate packing procedures and closer inspection of drag chute installations will help to eliminate this as the leading cause of barrier contacts.

Poor pilot technique during landing contributed to a substantial number of contacts. Landing too fast or too far down the runway and errors in operation of the various aircraft systems accounted for 35 of the incidents

There were three pre-planned approach-end engagements by hook equipped aircraft. All were successful cable pick-ups with a maximum runout distance of less than 750 feet. Two resulted in minor damage when the nose gears sheared. These were the result of the nose wheel being off the runway at the time the cable was picked up by the hook; consequently, the nose was rotated forcefully against the runway. Major commands consider approach-end engagement as a valid concept when aircraft control is questionable after landing. The lack of published procedures in the Dash-Ones has limited the number of attempts to date. ASD has initiated a program for determining the best procedures for making approach-end engagements in all century series aircraft. This program will be used as the basis for including approach end engagement procedures in the flight handbooks of hook equipped aircraft and is expected to be completed during 1964.

The experience gained from both inadvertent and pre-planned approach-end engagements dictates that caution must be exercised in determining whether this technique should be used. For example, in one case, when the nose gear of an F-102 aircraft failed to extend in flight, the pilot elected to attempt an engagement on the approach end. The aircraft hook engaged the barrier cable while in a landing attitude. The nose slammed into the runway causing major damage but no injury to the pilot. This particular type and model aircraft has an excellent record of landing with the nose gear retracted with little or no damage. Thus there is some question of the propriety of an approach-end engagement in this instance. This is cited merely to discourage any considerations that may have led to a wholesale acceptance of approach-end engagement as a norm rather than an exception. It is not intended that even in the case cited that it should be prohibited. Commanders, supervisors and pilots must be allowed the prerogative should other considerations warrant such an attempt being made. ☆

CAUSES OF FAILURE TO ARREST BY TYPE OF AIRCRAFT

	T-33	F-84	F-86	F-89	F-100	F-101	F-102	F-104	F-105	F-106	Other	Total
Aircraft Speed Too Slow	7	2	2	0	3	0	2	0	2	0	1	19
Speed Brakes Deflected Cable	1	0	0	0	0	1	0	0	0	0	0	2
Landing Gear Retracted	0	0	0	0	0	1	0	0	0	0	0	1
Hook Skip	0	0	0	0	2	0	1	0	0	0	0	3
Webbing Cut by Pitot Tube	2	0	0	0	0	0	0	0	0	0	0	2
Barrier Not Designed for Aircraft	0	0	0	0	0	0	0	0	0	0	5	5
External Stores	0	0	0	0	0	1	0	0	0	0	0	1
Other	1	0	0	0	2	0	0	0	0	1	0	4
Total	11	2	2	0	7	3	3	0	2	1	6	37

CONDITIONS INDUCING BARRIER CONTACTS

Materiel

Drag Chute System Failures	151*
Brakes and Hydraulic System Malfunction	34
Loss of Engine Power	27
Tire Failures and/or Gear Malfunction	24
Flight Control Failures	6
Other Materiel Failures	9
	251

Personnel

Pilot — Poor Landing Technique	21
Intentional Engagement	12
Other	2
	35

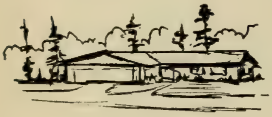
Air Base

Wet Runways	18
Crosswind	4
Obstruction on Runway	1
	23

Other	4

*Includes 32 Combinations of Drag Chute/Brake or Drag Chute/Wet Runway

Aerobits



HOW IS AN AIRPLANE LIKE A HOUSE? Well, if the housekeeping is bad enough it will finally get to the point where you can't live in either one of them. The items about to be related are not fiction, but cold, and pretty sad, fact. They are taken from reports based on inspection of just two aircraft. There are many others, but there aren't enough pages in this magazine to list them all.

Wheel well door switch and wires to switch soaked with oil; corrosion on various cannon plugs and connections including the main fuel shutoff relay; wire in connector broken and gasket torn; various screws loose and oversize clamps; equipment loose in bracket; screws, drill bit, washers, nuts, tape, bugs and dirt; canopy seal torn; loose bolts, loose cannon plugs not safetied; various hoses and wire bundles chaffing; lines and flanges cracked; fuel feed line not properly clamped. (This last item was considered to be potentially very dangerous. In fact, it was felt that in this condition the aircraft would not have flown very many more hours before a serious fuel leak would have occurred.)

As previously stated, this is just a sampling from a much longer list.

Undoubtedly there are many lessons that can be derived from examining the list of discrepancies and pure carelessness associated with these aircraft. We're not going to dwell on this except to say to pilots, how about taking a close look at the aircraft you fly. Would you accept one of the aircraft from which the above list was taken? And to maintenance personnel, are you satisfied with the product you hand to the aircrews to fly?

Some honest answers to these questions would undoubtedly mean fewer aircraft on the junkpile at year's end.

USAF has recently approved a procedure wherein the weather observer will be authorized to listen in as aircraft control is transferred from ARTC Centers to RAPCON. This will permit the weather observer to have advance notice of all inbound IFR traffic. Tests disclosed that the procedure provides the weather observer with tremendous motivation, as a member of the control team, to assure safe landings. Prior knowledge of landing traffic, even in periods of rapidly changing weather, allows time for the observer to check and recheck the meteorological conditions which will have an influence on the landing. This procedure is another step in insuring that the landing pilot has the most current weather information.

Installation of a receive-only drop in the representative weather observation site on the line between ARTC Centers and RAPCON (or comparable facilities overseas) is authorized. Commanders are urged to install this inexpensive facility. Your staff meteorological officer has additional information.

Lt Col Jerry Creedon, AWS Liaison Officer
Directorate of Aerospace Safety

C-NOTE PAYOFF. It is seldom that an author has the satisfaction of knowing that something he published in a safety magazine had a direct bearing on preventing an accident. Therefore it is gratifying to hear about incidents such as the following, which might have become an accident.

After takeoff, while accelerating through 290 knots, the pilot experienced a hard left rudder deflection and a violent yaw. He immediately climbed to 3000 feet and reduced his airspeed below 290 knots. The rudder returned to neutral. Airspeed was held below 290 knots, fuel burned down to landing weight, and the aircraft landed safely. Prior to the flight, the rudder feel system cylinder was removed and reinstalled backward because the T.O. was not correctly followed. The significant point is that the pilot had remembered a similar incident published and took proper corrective action and prevented an accident. This was not the first payoff for getting the word out on this type malfunction.

The incident this pilot remembered was contained in a brief written by Lt Col Jackson Saunders in the October 1960 issue of AEROSPACE SAFETY. A similar incident occurred subsequent to the one reported by Lt Col Saunders.

Since this particular brief (we used to call them C-Notes) probably saved two aircraft and possibly some lives, we are reprinting the original in hopes that if a similar incident should ever occur again another potential accident can be prevented.

"During a recent test flight for rudder actuator and rudder feel-cylinder change, an RF-101A went into a series of uncontrollable yaw oscillations whenever the airspeed went above (approximately) 285 knots. The first indication of trouble occurred on takeoff at about 285 knots, 800 feet over the end of the runway. The aircraft yawed violently to the left, followed by a series of uncontrollable yaws and tendencies to roll and pitch. Ground observers said that it yawed as much as 80 degrees, enough to present a complete side view of the airplane. At this point the pilot retarded the throttles to idle and raised the nose, and as the airspeed dropped below 270 knots, he regained control.

"The pilot initiated a slow climbout away from the base, turned off the yaw damper, and pulled the autopilot circuit breaker. The aircraft was leveled off at 6000 feet and immediately went into another series of uncontrollable yaws, pitches and half rolls. The pilot advised the tower that he was abandoning the aircraft. Due to G forces, however, he was unable to grasp the ejection handles. He then decided that his best chance to eject would be in a deliberate pitch-up so he pulled the nose up sharply, and as the aircraft reached a near vertical position, control was again regained. Once more the aircraft was leveled off and the speed brakes extended. By now the pilot suspected that the airspeed switch had some bearing on the difficulty.

"An airspeed of approximately 250 knots was maintained while the pilot made several turns to see if control could be maintained. No control problems were encountered at this speed and the gear and flaps were lowered for a straight-in approach and landing. An uneventful landing was made with 11,000 pounds of fuel remaining. Here's what the postflight investigation revealed:

"With hydraulic and electrical power on the aircraft and an MB-1 pitot static tester installed, it was noted that any time the airspeed reached 287 knots the rudder would immediately go full left. Bleeding off pitot pressure would return the rudder to neutral at 270 knots.

"Further investigation revealed that the rudder feel cylinder (P/N 20-91390-1) was incorrectly installed—in fact it was upside down. Installed in this position, the cylinder is allowed to extend full travel when the shut-off valve is energized at 290 + 10 knots. Full extension of the feel cylinder in this manner will actuate the rudder servo to the full left position. With the aircraft in an extreme yaw, pitot pressure will bleed off, allowing the airspeed switch to open, deenergize the shut-off valve, return the feel cylinder to the low speed condition and the rudder to neutral. This condition, plus attempted recovery control by the pilot, would account for the rapid yaw oscillation. The rudder feel cylinder was removed and reinstalled correctly. Subsequent ground operation revealed rudder control and feel cylinder to be normal."

A pat on the back for old C-Noter Saunders for sounding his note so true and proving that safety tips do pay off.

Maj James O. Modisette, Jr.
Directorate of Aerospace Safety

MISSILANEA

DON'T DROP THAT GUARD! During an ADM-20C (Quail) propulsion system checkout, with the engine operating at approximately 94 per cent, there was a loud noise similar to an engine compressor stall. The throttle was immediately retarded to the "off" position, emergency shutdown button was depressed, and an immediate engine shutdown resulted.

Investigation revealed that the engine inlet screen strap assembly, which is held in place by tension, had become disconnected, possibly due to vibration caused by the engine operation. This allowed the engine inlet screen at the left side to drop down approximately one-half inch. The metal cable was drawn into the compressor section of the engine and approximately 29 inches of the cable was ingested. All variable inlet guide vanes and all first stage compressor blades within the engine were damaged. An engine change was required.

It has been recommended that the bracket retainer screen, PN MDE 4449003-3 and MDE 4449003-5, on all engine inlet screens be modified to enable a locking pin to be installed. This modification will prevent inadvertent release of the buckle on the strap assembly. In the meantime, let's make sure that all engine inlet screens are properly installed prior to any engine ground operation.

HOUND DOG PROGRAMMER TIMER FAILURE—During an AGM-28B captive flight, the low fuel light came on with normal valve operation (B-52 fuel) and shortly thereafter the missile engine flamed out. The engine was restarted and operated normally except for the low fuel light staying on during the remainder of the mission.

Maintenance investigation revealed a shorted programmer timer and burned wiring internally in the relay distribution box and along the "I" beam. Later, maintenance revealed the armament junction box had an internal failure.

The suspected cause of the inflight malfunction was the shorted programmer timer (PN 7E1083-4). During the past three months there have been five programmer timer incidents that have resulted in electrical fires within the missile. These failures are being investigated by the prime depot. Results of this investigation will determine the correct action required to prevent future failures of programmer timers applicable to AGM-28A/B missiles.

Major E. D. Jenkins
Directorate of Aerospace Safety

RELUCTANT BULLPUP. One more piece of the AGM-12B failure-to-launch puzzle has been fitted into the picture. As a result of detailed investigation of several failures to launch, some obscure factors were brought to light about the Bullpup. The initial investigation by the unit cleared the missile igniters, motors, and missile center sections as suspect components. In fact, all were subsequently launched successfully. The aircraft compoments also received a clean bill of health. This left only the nose section to be investigated. A TDR contract was approved and these TDR's revealed that when the missile had received the launch signal and failed to launch, the thermal battery, airbottle, and gyro in the missile nose section were expended. This constitutes missile damage and is reportable in accordance with paragraph 7f(4), AFR 127-4.

The investigation also revealed that a small degree of turn of the igniter, short of the fully seated position, would break the electrical circuit, causing failure to launch. This could easily result from the press of aircraft launch preparations when the igniter is installed in the aircraft "hot-gun arming" area. The Directortae of Aerospace Safety, MAAMA, OOAMA, and TAC studied a proposal to install the igniter in the storage and buildup area where time and additional care could be taken to insure a fully seated igniter. Studies and electroexplosives tests confirmed the safety and desirability of this procedure. It is anticipated that this action will eliminate failures to launch from improperly seated motor igniters. Checklists outlining this procedure for F-100, F-4C, and F-105 aircraft are being distributed by AFLC and checklists will be out soon on the remaining applicable aircraft.

Three other ways a failure to launch can occur follow:

1. Pilot action. If the pilot releases the missile firing button before the thermal battery has closed the ordnance firing relay in the aircraft, a failure to launch will result. The thermal battery can require up to two and one-half seconds to complete its relay closing function.

2. Ordnance firing relay failure. Failure of the ordnance firing relay in the aircraft will also interrupt the fire signal causing a failure to launch.

3. Gas grain generator failure. Failure of the gas grain generator to rupture both the fuel and oxidizer diaphragms will cause failure to launch.

Therefore, if you have a failure to launch, the aircraft electrical system with its launch control components should be thoroughly investigated. If the aircraft system checks out successfully, report the mishap and request a TDR on the missile. However, if the investigation reveals that the aircraft system malfunctioned and a launch signal was not sent to the missile, the missile can be returned to the inventory and used on subsequent missions.

There we have a quick rundown on why some AGM-12B Bullpups are reluctant to launch. Continued detailed investigation and meticulous analysis and reporting by unit investigators and safety officers are, and will continue to be, important keys to missile mishap prevention. ☆

Major H. M. Butler
Directorate of Aerospace Safety

WELL DONE

CAPT. JOE H. WATSON

57 AIR RESCUE SQUADRON, APO 406 NEW YORK, N.Y.

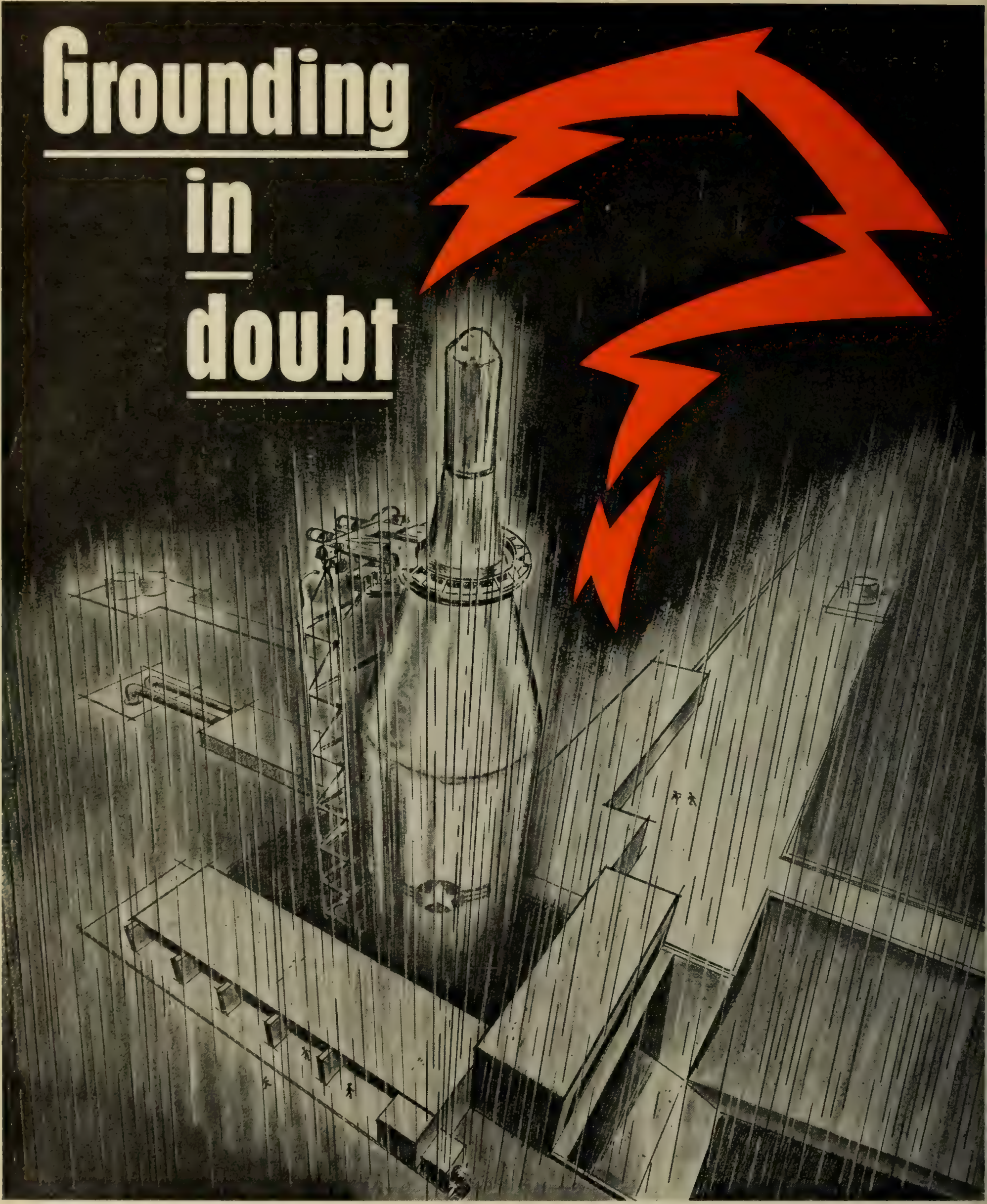
Captain Joe Watson and his crew were flying a pararescue training mission in an HH-19B helicopter in an overwater area near Lages Air Base, the Azores. After the last pararescueman departed, Captain Watson began a shallow descent from 3000 feet toward Lages. Immediately after receiving landing instructions, he heard a loud "thump" accompanied by severe fuselage vibration. A feedback in the controls was felt without tendency of the aircraft to pitch in any particular direction. A check of the engine and flight instruments, although blurred from the vibration, indicated that all systems were functioning normally.

Due to the severity of the vibration, Captain Watson decided to land the helicopter in the first available clearing. However, when rudder was applied to compensate for torque, the vibration increased dangerously. The rudders were quickly neutralized and the decision made to land using only forward speed for directional control and without the aid of rudders. Because of the restricted open and sloping terrain, this technique demanded the utmost in pilot skill and precise timing. A successful emergency landing was made in a small grass field enclosed by a four-foot high rock wall, incurring no damage to the aircraft or injury to the crew.

Investigation revealed that the skin had separated from the spar of the tail rotor blade. The slip stream peeled the skin off the blade, leaving the spar and ribs exposed. The unbalanced tail rotor, turning at more than 2400 rpm, caused the severe vibration and control difficulty.

Captain Watson's quick response and skillful handling of his aircraft under adverse conditions averted possible loss of life and equipment. Well Done! ☆

Grounding in doubt



CHECK IT OUT

See

- AFM 32-6
- AFM 88-9 CHAP 3
- AFM 127-201
- TO 31-10-24
- TO 11N-20-2
- TO 31-1-175

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

NOVEMBER 1964

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AEROSPACE
SAFETY

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FALLOUT

ASK AND YOU SHALL RECEIVE

The September 1964 issue just distributed had one slight inaccuracy which apparently slipped past your proof readers. In the article entitled "Ask and You Shall Receive" by Major Palmore, he cites the list of VHF and UHF frequencies which may be used for contact with the FAA Flight Service Stations as 134.9, 122.1, 126.7 and 255.4. First of all, the 134.9 cited in the article is not correct. That frequency is not available at any FSS. Secondly, FSS do not have transmission capability on 122.1. A quick check in the Enroute Supplement will show that the correct and complete list of standard FSS air-to-ground communications frequencies is: 135.9, 126.7, 122.1R, 122.2T, 272.7 and 255.4 mc.

I bring the above discrepancy to your attention in the interest of assisting you in maintaining the general high quality of presentation to which we readers have become accustomed.

Maj. Fredrik E. Anderson
Ohio Wing, CAP

WHAT IS SAFETY

I was interested in your editorial, "What is Safety?" (ASM, May 64) because of the various concepts of safety. In line with this, I would like to offer one not mentioned that I believe is most important of all.

Safety is a habit!

It is the habit of fastening a seat belt every time you sit in a car. A habit so instilled that it is fastened naturally, without thought. It is the habit of completely stopping at every stop sign regardless of the hour or how clear the field of vision. It is the habit of performing maintenance inspections according to the procedures established by experts; the habit of resisting short cuts to save time or because of a momentary inclination toward complacency.

It is the habit of being safety conscious; of taking precautions. It is the habit of expecting the worst turn of events in any situation — a child darting out from behind a parked car as you are driving down the street — another driver not yielding the right of way. It is the habit of gingerly checking your brakes on icy roads or during wet weather so that you will know what braking action to expect and can make necessary allowances.

The list goes on and on.

The inclination to relax a safety habit is often very strong, especially if it appears to be insignificant. However, consider the driver who had a habit of checking behind his car before he backed out of his driveway. After years and years of practicing this habit, can you imagine his trembling relief when one time he found a small child innocently playing in the sand behind his rear wheel? You can be sure that he will be eternally grateful for establishing that safety habit.

Maj Roger B. Condit, Jr
Selfridge AFB, Mich

BAILOUT FROM A KC-135

On the evening of 10 July the first recorded bailout from a jet transport occurred. Two members of the crew successfully bailed out, the rest of the crew stayed with the aircraft which subsequently landed safely. Since this incident is a first *and the information it furnishes may help others, the following account of the experience by the navigator, Captain Robert A. Searle, is presented.*

We took off as second ship in a three ship MITO (Minimum Interval Takeoff). Approximately six minutes later we experienced a small explosion and simultaneously a fire warning light from Nr 3 engine. As most people know, a fire in a jet engine is not normally considered serious because they tend to extinguish as soon as fuel is shut off to them. However, this fire continued to worsen and the boom operator, who was scanning from the overwing position, reported the fire was beginning to burn into the wing.

We had already left the formation and were descend-ng, building up airspeed attempting to blow out the fire. We were at 11,000 feet when the incident started; when the aircraft commander decided on bailout he eveled the aircraft at 9000 feet.

I had been busy talking to Clinton-Sherman ground control and hadn't gotten around to putting on my hard hat. Since we were as low as 9000 feet and I did not need oxygen, I decided against taking the extra time needed to put on my helmet and attach my oxygen mask to the bailout bottle. I immediately proceeded to he escape hatch to activate the chinning bar which would jettison the door and extend the spoiler. I had difficulty extracting the safety pin and called on the boom operator for assistance. He was successful in removing the pin although he did have difficulty. (Since his incident, a change calling for removal of the pin while on the ground prior to flight has been made on the preflight checklist.)

As soon as the hatch was jettisoned there was a oud roar from the rush of air. The noise level was o high that we communicated through hand motions nd shouting. In addition to the normal alarm bell, we have a klaxon type horn which sounds along with he bell for emergency signals. When testing this sys-em during preflight I find this horn aggravatingly oud. However, with the escape hatch gone, the noise evel is so high that the horn can barely be heard. If had not been watching the copilot make the positive motion of ringing the alarm bell, I probably would not ave associated the faint noise with that of the horn ecause it was only a hint of additional sound.

As soon as I saw the pilot retard the throttles and xtend the speed brakes I got on the chinning bar, acing aft, lifted my knees to my chest and pushed myself away from the bar and through the chute. I rossed my arms grasping the harness and tucked in my head. I tried to make myself into the smallest ball possible. The boom operator reports that the airspeed when I left the aircraft was 330 knots indicated airspeed. I got quite a jolt when I hit the slipstream and I started to tumble immediately. I estimate that I passed under the left wing root and cleared the fuselage by three to five feet. If the gear had been down I think it would be questionable as to whether or not I would have cleared it. As soon as I saw that I was completely clear of the aircraft, I extended myself some and pulled the ripcord of my chute.

I was rotating, facing the ground, when the chute popped. The opening shock was less than the shock of first entering the slipstream. As soon as the chute blossomed and I was safely sitting in my harness, I looked over my shoulder to see if everybody else made it. I could not see the aircraft, but I did see the boom operator's chute opening about a mile away from me; I could not see anyone else. I then started thinking about where I was, where I was going to land, and how I was supposed to land and spill the chute. I saw that I was about seven miles west of Clinton-Sherman AFB and about four miles south of Route 66. I started drifting rapidly north and I was becoming concerned about landing on Route 66 amid all the traffic. However, I was very fortunate in that I landed in a cotton field about 200 yards south of the highway. As soon as my feet touched the ground I started activating my quick release. I rolled along the left side of my back and my chute spilled immediately.

I gathered up my chute and started walking out of the field toward a dirt road where a car containing three young civilians was waiting for me. They had seen the whole thing and came looking for me. We stopped another car and we all went looking for my fellow crewmembers. When we got to the field where I estimated the next man would have landed, my companions went into the field to search and I went to a farm house to call the command post. While I was on the phone talking to the controller, he received word that the rest of the crew were safe. I then started to the base.

In critiquing this incident later, one thing became prominent as a possible major contribution toward our successful bailout. When we departed at such a high speed the pilot had the speed brakes extended while maintaining a level attitude. This forced the aircraft into a nose down attitude. This attitude might have given us the additional clearance we needed to clear the fuselage with as much space as we did.

A Landing Accident Study shows that one-third of all Air Force aircraft accidents occur . . . . .

When It's Almost Over

In today's Air Force one of the most satisfying individual thrills that remain for the pilot is a good landing.

In some cases, in the older birds (a la C-47) the satisfying "squeech, squeech" is still the mark of success at this point. In others, because of high wing loadings, high pressure tires, stiff struts and safety dictated considerations, a good solid, no bounce arrival is the optimum.

It would appear logical for pilots, being professionally proud, to always concentrate every bit of ability and skill on making good landings — this maneuver alone being the best way in which they can exhibit mastery of their profession to fellow crewmembers, passengers and onlookers.

There is another reason, not as satisfying perhaps, but certainly just as compelling. When the mission has been flown, when it's almost over, this is the point in time when one-third of all Air Force aircraft accidents occur. Moreover, almost half of these accidents are charged to pilot error.

Every third day, sometimes more often, an Air Force aircraft is damaged in a landing accident. Aircraft are invariably heavier on takeoff, but two to three times as many accidents occur on landing. Although the inflight phase accounts for the greatest total number of accidents, weight must be given to the fact that the time exposure during the inflight phase is much greater than the time exposure during the landing phase.

The fact that the landing phase is particularly hazardous has long been known, and considerable work has been done to reduce both the number and severity of such accidents. Runways have been lengthened, overruns stabilized, drag chutes installed, tire treads changed, lighting improved, approach zone and runway weather reporting made more accurate, barriers installed, braking conditions reported, techniques refined and publicized — these are but a sampling. It's a little terrifying to contemplate what the landing accident rate would be without such work.

ANALYSIS

The 195 landing accidents in the 17 month period ending 31 May 1964 accounted for approximately one-third of all aircraft accidents during the period. (Table 1)

Table 2 breaks down these accidents by causative agency. From this table it can be seen that pilot error is the cause of more such accidents than any other single factor. Nearly one-half of the landing accidents are pilot caused, whereas only one-third of all aircraft accidents are charged to pilot error. Figures for the first five months of 1964 indicate that pilot error as a landing accident cause factor may be on the increase.

Table 3 breaks down the landing phase into approach, flare-out and landing roll, and then by causative agency. Since flare-out is a small part of the landing phase, the number of accidents is proportionately small. This table shows that the number of pilot error accidents is about the same on the approach as on the landing roll. However, materiel failure accidents occur more frequently on the landing roll, as might be expected.

PILOT FACTOR

Table 4 provides a breakdown of pilot factor accidents during the 17-month study period. This chart discloses that the largest single cause of pilot error landing accidents is landing short. Of the 17, in only two were emergency problems associated with the landings. In one case the throttle was stuck at 90 per cent and in the other the only problem was a minimum fuel condition. Fifteen of the landing short accidents occurred with normally operating aircraft and must be attributed to misjudgment on the part of the pilots concerned. In one case GCA instructed the pilot to go around because the aircraft was too low. The pilot decided to attempt to land, reporting that he had the runway in sight. In one case a pilot tried to exceed the aerodynamic capability of his aircraft when he attempted to line up with the runway late in the approach. One accident resulted from an aircraft being caught in vortex turbulence prior to touchdown and others were due to attempted flight on the backside of the power curve.

The second greatest cause of pilot factor landing accidents was attributed to gear up landings or retracting of the gear after touchdown. Typical of this type of accident is the following: Pilot was lead for landing. Speed brakes extended on descent. They were retracted and a call made to the tower that gear was down and brakes checked. Aircraft landed gear up. Pilot forgot to lower gear or make check.

In the 11 cases in which accidents resulted when pilots lost control during the approach, most indicate failure to abide by Dash One procedures. For example: A pilot was making SFO's for upgrading. On turning final he stated that he was going around. The aircraft got into a nose high attitude and the pilot was unable to recover. The subsequent low altitude ejection was unsuccessful. Cause was attributed to poor judgment and improper SFO and go-around procedures. Sometimes an emergency or distraction lures the pilot into a fatal trap. It is basic that aircraft always be flown within safe airspeed and altitude parameters during the approach and landing phase. No emergency or distraction can be permitted to override the primary consideration for maintaining safe altitude, attitude, and airspeed. Here's an example. The T-33 pilot flew by

TABLE I
MAJOR/MINOR AIRCRAFT ACCIDENTS BY PHASE OF OPERATION

	1963		Jan - May 1964	
PHASE OF OPERATION	NR	PCT	NR	PCT
Eng. running, not taxiing	8	2%	2	1%
Taxiing	14	4%	5	3%
Takeoff	52	13%	28	16%
Inflight	173	43%	87	48%
Landing	142	35%	53	29%
Go-around	10	3%	5	3%
TOTAL	399	100%	180	100%

TABLE II
LANDING ACCIDENTS BY CAUSATIVE AGENCY

	1963		Jan - May 1964	
Causative Agency	NR	PCT	NR	PCT
Pilot (and co-pilot)	58	40%	28	53%
Other Personnel	18	13%	9	17%
Materiel Failure	51	36%	15	28%
Misc	7	5%	0	0%
Undetermined	8	6%	1	2%
TOTAL	142	100%	53	100%

TABLE III

	1963				Jan - May 1964			
	Approach	Flare-out	Roll	Total	Approach	Flare-out	Roll	Total
Pilot	21	14	22	57	10	9	9	28
Other Aircrew	0	0	1	1	0	0	0	0
Supervisory	5	2	3	10	0	0	0	0
Maintenance	4	2	1	7	3	1	4	8
Other Persons	0	0	1	1	1	0	0	1
Mat. Failure	20	3	28	51	4	4	7	15
Airbase	0	1	3	4	0	0	0	0
Weather	0	0	1	1	0	0	0	0
Misc. Unsafe Cond.	2	0	0	2	0	0	0	0
Undetermined	6	0	2	8	1	0	0	1
Total	58	22	62	142	19	14	20	53

TABLE IV
PILOT FACTOR LANDING ACCIDENTS

Landed short	17
Gear up or retracted after touchdown	14
Bounced or poor landing	11
Lost control on approach	10
Lost control on rollout	7
Failed to execute missed approach	4
Drag chute failure	4
Blew tire	4
Went off end	3
Descended below minimums	2
Crashed on emergency landing	2
Adverse winds	2
Asymmetrical reversing	1
Miscellaneous	5

the tower to confirm that the landing gear doors were slightly cracked. The pilot was cleared for a short initial approach for a full stop landing. After the turn to base, the nose of the aircraft continued to drop to 45 to 70 degrees below the horizon until the aircraft crashed into trees. This one was charged against supervision on the basis that the IP allowed the pilot to fly the aircraft into a position from which he could not recover.

In another case the pilot was making a precautionary landing and allowed bank to become progressively steeper as he turned final. Ejection was too late.

Most of the 10 accidents that occurred as a result of bouncing or poor touchdown stemmed from such things as high, steep approaches, low airspeeds, rounding out too high, failing to round out in time, etc. They didn't all happen in the supersonic birds. A gooney bird pilot bounced, pushed forward on the control column, allowed the aircraft to veer off the runway, got it back on again, went off the other side and sheared the gear. The pilot of another prop-pulled aircraft failed to round out and knocked the nose gear off. An IP, demonstrating short field landings, caused an accident by directing the pilot in the left seat to arm the reverse mechanism with the aircraft still airborne. One prop went into reverse and a hard landing ensued.

In the eight cases during which control was lost in rollout, poor crosswind landing technique entered the picture, as did other failures to follow Dash One procedures.

MATERIEL FAILURE

Materiel failure was listed as the primary cause in 66 landing type accidents experienced during the period of this study. Accidents caused by this factor have not been included in this statistical breakdown and but a brief sampling follows as there is little, if anything, the pilot can do to prevent accidents caused by materiel failure. In fact, it should probably be noted that aircrew members, faced with materiel failure problems, have, by professional execution of emergency procedures, prevented many accidents.

Failures in gear, struts and gear actuating systems accounted for 29 of the accidents. Steering malfunctions caused nine accidents, brakes two, and tire failure but one. Although materiel failure type accidents encompass a broad spectrum, a few samples follow to give the reader some idea of the range of problems facing the Air Force in this area.

Following touchdown, the aircraft vibrated severely and ran off the runway. Several accidents of this kind occurred during the period and stemmed from such causes as binding of the steering mechanism, faulty components parts, failure of steering arms, jamming and bending.

The left main tire failed on a scramble takeoff. A piece of the tire hit the left upper gear door, driving a hydraulic brake line against the door attaching point and puncturing the line. No brakes were available on landing and the aircraft ran off the runway.

On gear retraction the pilot heard a loud thump and was informed that the left gear was hanging. By yawing the aircraft he was able to obtain a gear down indication. On landing roll the left main gear collapsed as a result of failed rivets in the gear attachment assembly.

On takeoff the left main wheel and tire assembly separated from the aircraft. Fibre locking nuts on wheel tie bolts had failed.

At 400 feet on final approach the engine RPM decayed suddenly to 1800. Engine and rotor RPM were synchronized but then RPM dropped to 1500 RPM. The pilot autorotated the helicopter into trees prior to ground contact.

MAINTENANCE FACTOR

Maintenance gets into the picture too — often because of little things overlooked, forgotten or not properly taken care of. Here's an example: After a normal landing following an air/ground gunnery mission the pilot was unable to engage nose wheel steering. The aircraft drifted to the right, the nose wheel went off the runway, struck a runway light and collapsed. Inadequate safetying procedure resulted in loss of a gland nut locking screw on the steering-damper unit, primarily attributed to inadequate assembly at the depot.

Here's another. During flight the low level wing fuel light came on. All tanks showed empty, or nearly so. The pilot attempted an emergency landing at a civil airport. He undershot the runway, then the aircraft bounced onto the runway and burst into flames. Because of improper installation, the main fuel strainer on the the left engine malfunctioned causing rapid exhaustion of the aircraft's fuel supply.

In another case, after engine failure, the pilot attempted a flameout landing. He undershot and the aircraft bounced into the air. The pilot ejected, unsuccessfully. The engine fuel pump spline drive shaft gear had failed due to improper installation.

On GCA final both engines of a twin-jet aircraft

flamed out because a T.O. had not been complied with. The crew had to eject.

A cotter pin was left out. This allowed the steering damper to move only to the right. When nose steering was engaged on the landing the aircraft ran off the right side of the runway.

AIRBASE FACILITIES

Airbase facilities were a major factor in only four of the landing accidents. Three of these involved landings on assault type strips, with inherent hazards much greater than found on normal runways. One occurred following a BAK-6 engagement.

In one of the most unusual landing accidents a T-33 was damaged when, following touchdown in extremely poor weather, the pilot had to leapfrog an F-100 to avoid a collision at the intersection of runways. The T-Bird was damaged when it mushed back onto the runway.

UNDETERMINED

Cause of nine of the landing accidents was listed as undetermined. In two cases the pilots lost control on turn to final, two others hit short and there were two ground loops. One pilot crashed after reporting he would land from a closed pattern and another flew into the water while circling for landing. One swerved to the right and ran off the runway.

CONCLUSIONS AND RECOMMENDATIONS

This study of landing accidents during the 17 month period ending 31 May 1964, discloses that prevention attention is needed because:

- Approximately one-third of all aircraft accidents occur during the landing phase.
- Half of the landing accidents are pilot caused.
- Landing short and gear up landings are the two leading factors in pilot error landing accidents.

Analysis and recommendations made by investigators of these accidents indicate that compliance with known approach and landing procedures would have prevented many. Selected at random, but typifying the suggestions made, are the following:

Use approach aids as a cross check during the approach — glide slope, GCA, VASI lights.

Never descend below approach minimums unless VFR.

Abide by recommendations of GCA when directed to make a missed approach.

If weather becomes IFR, don't attempt to continue VFR.

Compute approach and landing speeds and fly them.

IP's must not let a situation deteriorate beyond a point from where they can safely recover.

Attempting to make a good landing out of a poor approach is not as safe as executing a missed approach.

Pulling the nose up will not stretch the glide.

No emergency overrides the necessity of maintaining control of the aircraft — eject if the situation is untenable, and eject at or above minimum altitudes as specified in the Dash One.

On multi-engine aircraft maintain safe engine-out airspeed and altitude.

Apply brakes after landing — not before.

Slow to a safe speed before turning off the landing runway.

Comply with current directives on aircraft spacing.

Lower the gear before landing and don't pull the gear up after landing.

Divert to an alternate or hold if weather precludes a safe approach.

Go around, don't attempt line-up turns late in the approach.

If overshooting, go around.

Flare so as to not land nose wheel first.

If disoriented, ask. Don't land at the wrong field.

Remember that one of the safest recovery techniques from a poor touchdown is to go around.

Tightening the final turn to line up with the runway is not as safe as starting the turn sooner and, if necessary, shallowing the bank to line up.

Depth perception deteriorates over water, at night, over snow-covered surfaces, when terrain slopes, during precipitation, on overcast days, when the pilot is fatigued and when he does not use oxygen.

During gusty wind conditions, don't fly at minimum control speed.

Study NOTAMs before departure. Know and plan for hazards of airfield construction.

Pre-brief — avoid confusion in the cockpit.

Use checklists. ☆

One wintry day back in 1959 an observer on the flight line at Wright-Patterson AFB might have noticed that an unusual number of aircraft were aborting their takeoffs. Had he investigated further he would have found that the stops were not due to malfunctions but that the aircraft were being deliberately stopped in tests to obtain stopping distances. On the sidelines men were busy checking the stopping distances against Runway Condition Readings (RCR) obtained with a gadget called the James Brake Decelerometer (JBD).

Flight test engineers of the Directorate of Flight and All-Weather Test had just initiated a program to correlate deceleration readings from the JBD with the actual stopping distance of various aircraft. As the program progressed it became evident that an accurate system could and should evolve.

Aircraft used in that test were a T-33, F-100, 101, 102, 106, B-47, KC-135 and a C-131. With about two inches of slush on the runway they were accelerated to 100 KIAS, the pilot would call "brakes now" and the stopping distances were recorded. The JBD reading and slush depth, which had been obtained immediately before each run, were then correlated with the stopping distances.

Information of this type continues to be gathered on aircraft such as the T-37, T-38, T-39, F-105 and the F-4C during the Category II All-Weather Test programs. Slush, ice, packed snow and wet runway information has been accumulated, sorted and plotted. The end results are the data sheets you find in the Dash One.

This program of data gathering has some shortcomings and problems. Flight test personnel felt from the beginning that a valuable tool was available and they started out to exploit this value. However, initial support and directives to proceed full-scale were either weak or nonexistent. Typically, the decision to conduct a flight test program is the result of hazards involved versus priority of the requirement. In this case it was decided not to continue exposing a highly instrumented fleet of test aircraft to possible damage. For instance, during the initial phases of the slush test described above, the F-102 aquaplaned off the side of the runway into the soft dirt and bounced up over a taxiway. Luckily no damage was done and the tests proceeded without further incident. After the fact thoughts of possible damage or loss of aircraft during these tests, slowed the program. Finally, all that was being obtained was by-product data from Category II and other test flights. Subsequently, USAF dictated that our present program be implemented; i.e., T.O. 33-1-23, AFR 60-13 and all that goes with them.

RCR's are not as accurate as they could and should be; however, they are not dangerous! On the contrary, they are, in most cases, on the safe side; so, go ahead and follow them. The present system is a long step in the right direction, but here are some of the problems.

- About five years ago, a T-33 delayed braking on a wet runway at Farmingdale, New York, and skidded off the end. Investigation showed that the sealant used on this asphalt runway was very slick. JBD was 16 on a dry surface when the average should be 23 to 25.
- An air base in Michigan had continuous problems with F-102's off the side and off the end of its runway during rainy weather. Same problem—runway sealing compound.
- During Category II All-Weather tests in Alaska, the task force noted very good braking was available on packed snow when low temperatures existed. At or near the freezing mark, packed snow becomes slicker. Around 0° F. or below, JBD readings were much higher and stopping distances were shortened.
- Variables can and do exist on wet runways due to differences in runway surfaces, age of the runway, aggregates used in construction and type of runway sealants used. In some cases, dust on the runway can act as a lubricant when it becomes wet. Aircraft will aquaplane on standing water, whereas the vehicle obtaining JBD readings will

Lt Col Richard R. DeLong,
Directorate of Aerospace Safety

not—at least, not to the same extent. Long before JBD, AFR 60-13 and T.O. 33-1-23, I watched a B-29 aquaplane off the side of the runway when landing on a sheet of running water about one-half inch deep during a heavy rain. The runway was not crowned, but gently sloped from one side to the other. Not much damage, but "hairy" to say the least.

Another problem we have is in the directives covering the subject. First, the guidelines for average JBD readings in T.O. 33-1-23 are somewhat negated for reasons herein stated; i.e., variables due to temperatures and runway surface conditions. Second, the weather sequence doesn't indicate the percentage of runway that is clear or covered. It merely designates these conditions as patchy. It is not impossible that a 50 per cent patchy runway could give a lower reading than a 75 per cent patchy condition. It all depends on where the readings are taken. Hypothetically, take a runway with 50 per cent packed snow. The weather sequence could be reported as PSR 11 P. Eight of ten readings could be on the packed snow at JBD indications of 08. The remaining two readings could be on clear runway at JBD indications of 24. In this case we would have PSR 11 P. A more accurate weather sequence would be: RCR 24 PSR 50 per cent P 08. In other words, the clear runway is 24 and the patchy packed snow is 08. Should complete PSR exist, the sequence would then read: RCR 08 PSR.

The last problem, and perhaps the most important, is the lack of data on all aircraft under all conditions. A test task force of this magnitude would be difficult to justify and impossible to approve in these days of austerity.

Now, let's suggest some solutions.

1. Flight Safety Officers: Make this article required reading for all pilots and review it along with AFR 60-13 and T.O. 33-1-23 at a Flying Safety Meeting in the near future. If you need technical or operational assistance, write to Hq ASD, ATTN: ASZO, W-P AFB, Ohio, 45433. This is the Flight Handbook section and it has overall management/coordination responsibility for this data and the publication of charts for the Dash One handbooks. They also have immediate contact with the flight test engineering agency that coordinated the original tests described herein.

2. Operations Officers: Note in the remarks section of the AFTO Form 277, Results of Runway Braking Tests, the stopping distances required for aircraft under the conditions reported on this form. This is not to recommend that all bases conduct slick runway tests! (Leave the test business to the flight test people.) But, when extremely slick runways exist, it is assumed that the aircraft will, in many instances, be stopped in as short a distance as possible. In such cases, record the distances and the type aircraft on the Form 277. This information can be used by ASD to establish more accurate landing roll charts for the aircraft concerned. Make sure your Forms 277 are accurate and that personnel obtaining the RCR readings are experienced. (I have recently reviewed a package of Forms 277 from "X" air base which I strongly suspect were filled out and submitted for the sake of filling the squares. These were sent to me by ASD with the same suspicion indicated in their correspondence.)

3. Change the weather sequence to give a more realistic picture to the pilot, especially when patchy conditions exist.

4. Conduct a flight test program requiring that JBD correlative data be accumulated on the complete USAF aircraft inventory. This would permit braking tests to be conducted on any aircraft at any time a particularly desirable weather situation presents itself. These data can be obtained on landings or on accelerative ground runs.

5. DTIG will publish a report on procedures for taking JBD readings which documents results of a test program recently conducted by ASD (ASTFP). This report will be in the December-January FSO Kit. Reproduce it, distribute it, educate with it! This taking of JBD readings is not a horrendous, technically involved engineering task when everyone understands what it's all about.

Remember! The system is good; it can and should be used; it's an excellent, valid safety and operational tool; and YOU CAN HELP IT WORK! ☆

T-Bird Rocket Ejections

Maj Richard M. Chubb, Life Sciences Division, Assistant for Medical Services

A recent inflight emergency resulted in the first two T-33 ejections with the new rocket seats, at an altitude of 29,000 feet and 200 KIAS. Major injuries sustained by both pilots were carefully evaluated. None of the injuries could be attributed to the fact that rocket seats had replaced the ballistic catapult seats. There were a total of five major injuries, probably resulting from five separate causes, and a number of lesser injuries.

The pilot leaned forward as he pulled the trigger and felt his back snap with the initial thrust. A compression fracture was confirmed by X-ray. His malposition is confirmed by the fact that he was looking at the rocket smoke during propulsion. Although his chin strap was fastened and his visor was lowered, he lost his helmet as soon as he cleared the cockpit. The snap fastener for the chin strap was torn from its moorings, and the strap caused an abrasion as it passed under the jaw. He felt his right arm flail laterally and aft into the seat at about the same time. This resulted in his second major injury, severe contusions and a puncture wound above the elbow.

The seat separator worked as advertised and separated him forcefully. This started him in a forward somersault from which he managed to recover. He eventually stabilized on his back, with his head below his feet. He held his injured right arm at his side and kept his legs straight and his feet together. He then used his left hand as a rudder to hold himself in what amounted to a dive. He consciously refrained from opening his parachute because of the high altitude. He heard the chute deploy and saw it go past the back of his feet. His streamlined position gave him a nearly maximum descent rate and the greater than average shock was absorbed by his shoulders, producing severe contusions on top of both. A friendly aircraft circled during the parachute descent and he rather enjoyed the oscillations of 30-40 degrees produced by the prop wash. He descended gently through some trees and came to rest suspended in his harness about 4-5 feet from the ground. He lowered himself by jerking at the risers until he could touch the ground and then unbuckled his harness with some difficulty. He managed to walk a short distance before ground personnel met him.

X-rays of his pelvis revealed a linear fracture at the hip joint. It seems most probable that it occurred during opening shock of the parachute. We have no record of such a fracture being produced by ejection force. In addition, there were absolutely no bruises or tenderness over any portion of the hip to indicate a direct blow. He steadfastly denied any significant blows while descending through the trees, but it is possible that the tree landing was harder than he remembered.

The rear seat occupant had ejected first. He consciously positioned himself in what he thought was optimum position, raised both armrests and squeezed the trigger. He could see nothing until after seat separation when his helmet left him "like a bullet" as he started tumbling wildly. His chin strap had been fastened, but his visor was up. The oxygen mask was apparently forced upward and the plastic shield probably produced a minor laceration he had above the right eye. He was unable to stabilize his free-fall with any of the maneuvers he had studied. He satisfied himself that his automatic timer lanyard was gone and waited for deployment. After deployment of the parachute, he noted that both forearms were bleeding profusely. He applied pressure above both elbows at the pressure points by folding

his arms and concentrated on slowing the flow of blood. He, too, encountered severe oscillations from prop wash, but failed to enjoy the thrills provided. During descent he attempted voice contact with the other pilot, but was unsuccessful in this. While looking about for the closest help on the ground, he was distracted by a large power plant, a wide river, and high voltage power lines in his line of drift. He passed safely over the power plant and river, but his course was disconcertingly parallel to the power lines and directly over them. As he descended, he was near one side of the lines and over a cleared strip adjacent to them, with his back to the clearing. He therefore pulled hard on the aft risers and retracted his landing gear in order to make certain he cleared the wires. He almost immediately went through some small trees and came to rest sharply in the sitting position with his back squarely against a small second-growth tree. Although he at first described the landing as gentle, he did admit to seeing a few flashing lights, stars, and lightning flashes at that moment. The pull on the risers at the last minute probably started an oscillation that swung him against the tree. He had started to cut some shroud lines for tourniquets when he heard rescuers calling him.

Examination revealed a fracture of the spine, undoubtedly from his "gear-up" landing against a tree in an oscillation. The symmetrical lacerations of the upper forearm were almost certainly due to contact with the cockpit during ejection. It appears probable that his forearms were resting on the guards intended to contain the elbows rather than on the flat portion of the armrests. It is also possible that he moved his elbows laterally as he raised the armrests.

It is fortunate that few ejections result in so many examples of injury causation. Even in the rocket systems (which have less maximum thrust forces), a compression fracture can result if one leans forward. Both pilots were wearing underarm life preservers, and it is especially important to remember to pull the elbows in with these on. If necessary, the elbows may have to be forward slightly to allow clearance. Proper body position for parachute opening (bent slightly forward at the hips) is still a good practice. Parachute landing is difficult among trees and power lines and injuries are frequent. The Four-Line Cut (see "Better Break on Bailout," AEROSPACE SAFETY, July 1964) would have made both of these men more comfortable during descent and probably would have prevented one fractured spine. This modification is ideal for this situation. By cutting the two central shroud lines on each of the aft risers, a pouch is produced at the back of the canopy that dampens oscillations, slows descent, imparts 3-4 knots forward velocity, and provides steerability. These lines will be marked with red tape in the near future and instructions for this procedure will be forwarded to the field in T.O. 14D1-2-1.

The relation of these stories is meant in no way to be critical of these pilots. Both men had considerable presence of mind and did a great number of things better than the average ejectee. It is meant to show, however, that there are pitfalls that can be fatal in any ejection. These men were observed during their descent by another aircraft and by a large number of people on the ground. What if it had been a snowy night in a remote area? ☆

PEACHY'S DEAD . . .

DOGGONE!

Maj L. Berlow, Armed Forces Institute of Pathology, Washington, D.C.

Resting in peace at the tender *old* age of 17 is an unusual B-47 casualty.

It's in a small grave back of a Capehart house at Altus Air Force Base, Okla.

Peachy was neither pilot, navigator nor engineer — just plain ol' cocker spaniel.

Back in 1947, Moses Lake Air Force Base, Washington (it's called Larson AFB now), hummed with activity. Boeing's first XB-47 was being tested. Representing the United States Air Force was Captain (now Lt Colonel) Stephen A. Starr. Representing Steve — his faithful cocker, Peachy.

Captain Starr's job, aside from Base Commander, was to assist the 100 plus Boeing people in the shake-down of their new plane. This kept Captain Starr hopping from hangar to runway, busy with the million and one things required to get the plane operational.

And everywhere the Captain went his dog was sure to go.

That's where the problem began. Within a year Captain Starr noticed that Peachy was having trouble hearing. She'd stay closer to him and even had to be awakened by his shaking her. Veterinarians, after looking the patient over, announced that Peachy would never hear again. Over-exposure to jet noise, they said.

"I had been haphazard about earplugs for myself, and gave even less thought to the dog's hearing," reminisced Colonel Starr. "It took her sad condition to show me the way."

The moral of this story? Well, it all just goes to prove (somehow) that dogs and earplugs are man's best friends. ☆

When it comes to operation of two wheelers, Captain C. Z. Chumley learns it pays to....

Heed the Speed

Archie Caldwell – Directorate of Aerospace Safety

The early Sunday morning tranquility of 3115 one-eighty-first was being gradually shattered by a constantly increasing high pitched whine. The long suffering wife of the "World's Greatest Pilot" stirred uncomfortably in her bed and the fantastic thought of some monstrous wasp or hornet about to descend from outer space onto her house crossed the mind of Mrs. C. Z. Chumley.

The sound grew louder and Mrs. C. instinctively sat up in bed and reached for the reassuring form of her husband and provider. C. Z. was not there. A glance at the alarm clock showed it was 6:42 (A.M.).

"No, he couldn't have, even if he said he might!"

Mrs. C., hair curlers trailing, ran to the front door. The sound throughout the Wherry area had reached the staccato of a machine gun. She opened the door and took two steps onto the grass just in time to observe the hunched form of Captain C. Z. Chumley rounding the corner astride what appeared to be a two-wheeled, one cylindered cross between an English bicycle and a Highway Patrol Harley Davidson.

Chauncey broke into a broad grin as he shifted into a lower gear and the machine spat more fiercely. Pulling into the neighbor's driveway, up onto the sidewalk, C. Z. steered for Mrs. C. As the motorcycle hit the grass, Mrs. C. leaped into the doorway just in time to see C. Z.'s grin fade and the rear of both machine and rider disappear into the neighbor's hedge. The sound of the angry hornet stopped and Chaunce unceremoniously walked the machine into his driveway.

"Foot slipped off the brake," he offered in a joking way.

"More like your brain slipped," Mrs. C. tartly replied. "What is it?"

"It's a genuine BRATSAMARU, 150 cc motorcycle, that's what it is, and are we going to save the money on this one! Why, I can ride to work and the Jag can sit here for you. The little jewel gets 120 miles per gallon, speeds up to eighty, foot shift, all those chrome goodies. I tell you, my love, we have something here!"

Mrs. Chumley replied as to what *she* thought *she* had, but saw it was no use to push the conversation. C. Z. had a new toy and it would only be a matter of time.

Months passed. C. Z. had acquired a muffler in place of the "competition tube" (much to the relief of the neighborhood), purchased a safety helmet (required by base regulations), and had indeed saved money on gasoline by riding the motor to work. It was even refreshing for C. Z. to feel the breeze on those hot summer and fall days. But there was a nip in the air and a few sprinkles had already fallen. Roads were often slippery and the mornings and evenings were cold.

"Maybe it's time to put the motor up," Mrs. C. offered at breakfast as a light drizzle was falling outside.

"Nonsense, my dear, still months before the first snow will fall. It may be a little dampish, but nothing the old road runner here can't handle."

Chaunce gulped down his 19th Shredded Wheat, looked at his watch and with one effort knocked over his coffee cup, started for the back door and kissed his wife of many moons.

"See ya after the salt mines close." Chaunce popped his helmet to a jaunty angle, hit the starter and with a roar slipped the hand clutch. The "bike" shot out of the garage into the dreary morning. C. Z. was in second before he hit the street and was doing 40 before he got the corner. On the road to operations, Chaunce wished he had one of those face shields, or at least some goggles. The drizzle was turning to rain.

"Hmmmm—might just have to retreat and regroup," C. Z. thought. "Maybe it *is* about time to consider that a closed car would be better than being subjected to the elements." Chaunce mentally drew a picture of himself, snugly nestled in the warm confines of the new XKE Jag. His failing peripheral vision picked up a gray form coming in at 3 o'clock. A quick eye movement showed it to be a late model four door sedan.

"Look Out! You idiot . . . " C. Z. yelled, simultaneously hitting the horn and brakes of the motor. The BRATSAMARU reacted exactly like any motorcycle (or two-wheeled vehicle) would on such a slick pavement. The rear end shot out from under Chaunce like the hips of a cha-cha dancer, the front wheel cocked full over and both rider and machine began to scribe graceful loops across the street. The dance ended when the rear wheel slammed into the curb and C. Z. was catapulted like a falling cat across the grass of the headquarters lawn. He could feel the helmet part company and briefly caught sight of the sedan running over the curb on the other side of the street—then a red flash, shades of gray and darkness.

The heavy arm cast prevented the required salute so C. Z. smiled through two broken front teeth. His commanding officer, who had gained a reputation of having the patience of Job with Captain Chumley sat with palms together.

"Captain, I had hoped that we had dispensed with our little post accident talks. However, it seems that I just can't outguess your next moves. Now the accident report shows that among other things, you failed to yield the right-of-way, were exceeding the posted base speed limit, were not riding with due consideration to the road and weather conditions, failed to have your helmet chin strap fastened and . . . "

"It wouldn't have happened if that guy in the sedan hadn't turned right into me," C. Z. interposed.

"Several eye-witnesses have stated that Major Lee was completely without blame. You practically chased him onto the curb before you saw him and skidded. Now don't think you're the only lad that's ever checked out on a motorcycle. I've ridden them myself and still do—but with a liberal amount of caution. Any beginner knows enough to slow down when it's slick, or when visibility is cut down, and not to lock up both wheels with the brakes if at all possible. You should have cut your speed considerably as a result of the restricted vis, and the slippery footing."

"But I've gotten to know that motor of mine. I've got so I can feel the way . . . "

"You've gotten complacent, that's what you've gotten, Chumley, and that's what gets a lot of riders of motorcycles, scooters and other powered two-wheelers. In the years 1962 and '63, the Air Force lost 53 of its personnel in fatal accidents such as the type you had. And motorcycle fatalities rose last year over the previous. While they are a safe and sane way to travel, we just can't afford to sit back and accept an average of 400 accidents every year on two-wheelers. Ignorance of the machine is a prime factor in accidents although I must say it wasn't in your case. But we get too many cases of a fellow borrowing a motorcycle and finding the power and acceleration too great a temptation. It isn't pretty to pick up the pieces after a bike has hit something solid at say 80 or 90 miles an hour. Anyway, I'm revoking your base privilege for your motor until you can show you know how to use it with common sense. I also am establishing a formal course of riding instruction which will be supervised by the air police and ground safety. This course will be required for all motorcycle riders. You and I will attend the first class. Do you understand me?"

"Oh, yes, sir, from now on it's safety first, last and always. You'll see, it'll be low and slow. You'll see a change—that I can promise you."

"Very well, Chumley. Dismissed."

The Colonel sat alone pondering the effect of his little talk. Maybe Chumley would change. At least the problem had been brought to a head by Chumley's fiasco. He had been hard at work on the PMV problem, now he was determined to crack down on the motorcycle and motor scooter riders.

The adjutant opened the door and came in, shaking his head. "Never saw anything like it," he said in response to the colonel's, "What's the matter?" "Just had a captain stop and ask where to volunteer for some motorcycle safety school. Why, when I was a young fellow . . . "

"Haa-r-r-umph!"

"Sir?"

"The school starts Monday. Work out the details with Ground Safety and the Air Police. That captain—Chumley's his name—was right for once in his life."

The adjutant knew the Old Man's moods. He did the only thing he could, "Yes, sir!" ☆

I GOT A RIGHT

Lt Col John D. St. John, Chaplain, AFLC, Wright-Patterson AFB, Ohio

Nothing is more typically American than to stand up and shout: "I got a right!" Our intellectuals tell us that "natural rights" are an outmoded 18th Century ideology that no intelligent person holds today. But the vast majority of the American people, and the intellectuals themselves in practice, believe not only in natural rights but in far more such rights than can possibly exist together in the same society.

We have all been taught that the Founding Fathers held "these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain inalienable rights." If these words were only a phrase in the Declaration of Independence, they would be of merely historical interest. In fact, they state a principle that is still deeply rooted in our natural conscience and should by the same token be embedded in the individual conscience.

For many years now in magazine articles, in lectures, at Commanders' calls, mighty emphasis has been placed upon "Safety" and rightly so. Much emphasis too has been placed upon "Dollar Savings" as a direct end product of more "Safety". This too is most commendable especially in this day and age of "Project ICE," "Gold Rush," "Clearwater," and what have you. Yet I think it is opportune at this stage of the "Safety" campaign to emphasize another facet of motivation in this matter, viz., that of conscience. We as Americans are proud and happy to know that we have as a matter of constitutional decree as well as the natural right common to all of God's human creatures the "right to life, liberty and the pursuit of happiness." Therefore I maintain that the careless mechanic, the reckless driver, the sloppy pilot, the slip-shod flight engineer, the lackadaisical depot technician—all infringe upon our right to "life, liberty and the pursuit of happiness." Their irresponsible and inexcusable and, might I go so far as to say, sinful carelessness, has jeopardized our natural, God-given, and constitutional "right to life."

All of us have, I dare say, had harrowing experiences which subsequent investigation has shown were caused by some careless slob. I remember flying across the Atlantic a few years ago in a military transport plane. The passengers were about evenly divided between military personnel and their dependents, some of whom were infants in arms. A serious electrical fire broke out and panic spread rampant among some of the mothers. As a chaplain I was asked by the plane commander to assist in allaying their understandable fear and to help in preparing for ditching. I couldn't help but wonder what to do with the infants when and if we should hit. A chaplain is supposed to be a morale builder but, brother, my morale was pretty low just at that time! There was no other chaplain around to punch my card but this was not so disturbing when I could go to the Top via direct communication. I know that He heard our prayer. Tragedy was averted and we limped back to the Azores.

An investigation showed that a sloppy wiring job had caused the fire. Someone along the line "goofed" and may God forgive him for the soul-racking emotional distress and the needless suffering caused by his irresponsible action. In my opinion this careless person had made an indirect attack on the "right to life" of every person on board that aircraft.

We could go on and on relating similar experiences. All of us who have been in the Air Force for any length of time have "sweated it out" many times. But what about the good guys we have lost in accidents written off with a back of the hand—"cause of accident unknown." God knows the cause of the accident and so does the one who caused it in many instances. He sees in his anguished nightmares the twisted bodies, the charred remains, the bloated floating corpses—the memory of which will come back to haunt him to his dying day. Would that it were possible to take this criminal along when the chaplain goes to tell a heart-broken wife and mother and her children that their husband and daddy won't be coming home tonight.

We have the further right to "liberty and the pursuit of happiness." It is almost banal to say that we cannot attain liberty or pursue happiness in a coffin. Nor can we do the same on crutches or in a back brace or blinded or paralyzed to the full extent that Almighty God intended that we should and could be happy and healthy on this earth.

When we signed up for a tour of duty with the United States Air Force we did so with the clear understanding that we would defend our country against its enemies external and internal. This might and could mean that we would have to sacrifice our lives or our health in fulfillment of this ideal. We will do so gladly if necessary. However, it does not mean, nor even imply, that we must be willing to sacrifice our health or lives because of the carelessness or the neglect of another who is also wearing a blue uniform.

"I got a right"—we hear so often. Yes, we have a right to "life, liberty and the pursuit of happiness." Every time someone cuts corners in safety procedures he infringes upon my natural and constitutional rights. Every right has a correlative duty. So when we are tempted to cry out "I got a right" remember the rest of it too: "I got a duty"—a duty to respect my fellow citizens' rights because we are our brothers' keepers.

Let's keep that built-in safety check—"CONSCIENCE"—on "ON" all the time. ☆

MISSILANEA

"BALL PEEN" MAINTENANCE. Murphy's law and "ball peen" maintenance still plague the missile fleet. Two young lads, one with five years' experience and the other with over three years', were dispatched to install a new L-12 filter in the propellant loading system. Difficulty was experienced in placing the filter in its casing. When the filter appeared to be in the proper location, it would not move all the way forward in the casing. Here, Murphy's law took over and the old bit about "don't force it, use a bigger hammer" came into play. The maintenance troops secured the blind flange on the rear of the filter casing with two bolts and forced the filter forward. They took off the blind flange and the filter appeared normal. They then installed the required gasket and torqued the blind flange. Eleven days later, during a verification inspection of the site, the damage was discovered.

QUESTION: What could have happened if the site had been required to be exercised during the 11-day period?

QUESTION: Did a supervisor observe the activity and sign off the completed work?

When a situation is encountered which indicates abnormal accomplishment of maintenance, the wise thing to do is to check with the supervisor and not follow Murphy's law or try "ball peen" maintenance. An accident could have been caused by this example and, as in all accidents, it would have been completely needless.

Maj Curtis N. Mozley,
Directorate of Aerospace Safety

SWINGIN' GATE — A Mace missile was being moved from the maintenance complex to the launch site. As the vehicle operator approached the maintenance complex gate, the security guard opened the double gate but failed to notice that one gate did not lock properly. While the missile was passing through the gate, the wind evidently caused the unlocked gate to strike the missile wing support mechanism at the tip of the leading edge of the wing. There was no damage to the transporter, but the missile wing was damaged to the tune of an estimated 10 manhours to repair.

This accident was caused by personnel error, in that the gate security guard failed to properly secure the gate. Also, there was supervisory error because the gate security guard did not have a written SOP to govern his actions. Further, the gate security guard had not received a verbal briefing on his duties and responsibilities.

Gate security guards now have a written SOP which they are required to read and initial prior to start of guard duty. This SOP contains a note which requires guards to insure gates are locked prior to allowing vehicles to proceed.

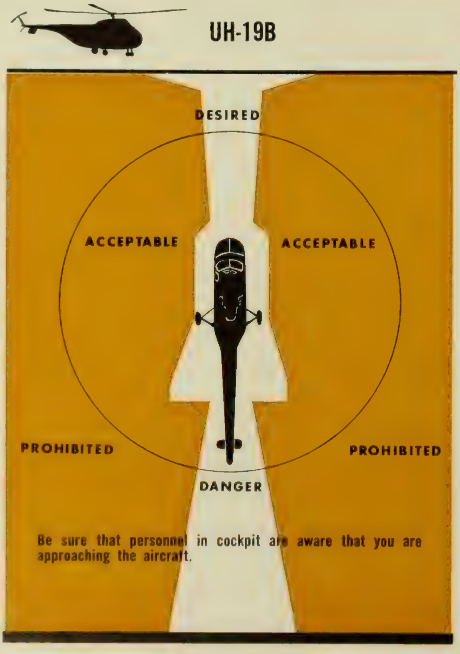
Lt Col John A. Worhach
Directorate of Aerospace Safety

DROPSY. An AMA team had completed its work on the silo door mechanism of a Titan II complex and were descending on a portable ladder to Level 1 of the launch duct. As one technician descended, he carried in one hand an unsecured pneumatic drill with bit inserted. As might be expected, the drill slipped from his grasp, falling through an opening in the work platform, richochetting off various protuberances before it came to rest on a thrust-mount at Level 7. A check revealed that in its fall, the drill had dented the electrical conduit and autogenous line cover of the missile in five places.

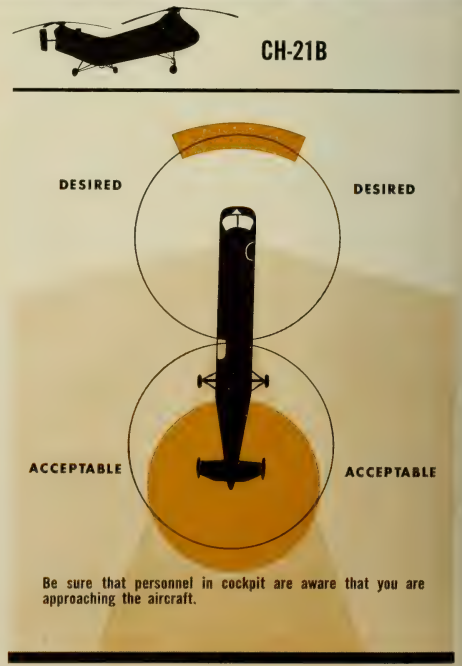
In one respect it can be said that this was a lucky mishap—that it didn't strike the missile skin proper—perhaps only a few inches making the difference between a mishap and an accident.

The need to brief an experienced technician on how to move equipment from one level to another may not always be this obvious. Nevertheless, as shown by this example, even the most experienced people sometimes become careless because they may not be thoroughly familiar with their working environment. Personnel should be thoroughly briefed on the handling of equipment in missile environs, emphasizing that unless equipment is small enough to be safely secured to the person, it will not be carried when climbing from one level to another. ☆

Maj Kearn H. Hinchman
Directorate of Aerospace Safety


UH-19B

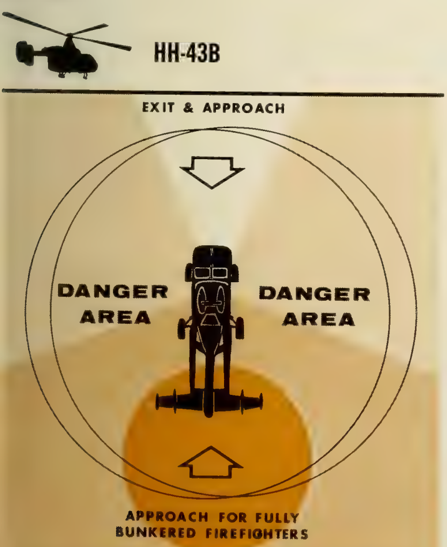
Be sure that personnel in cockpit are aware that you are approaching the aircraft.


CH-21B

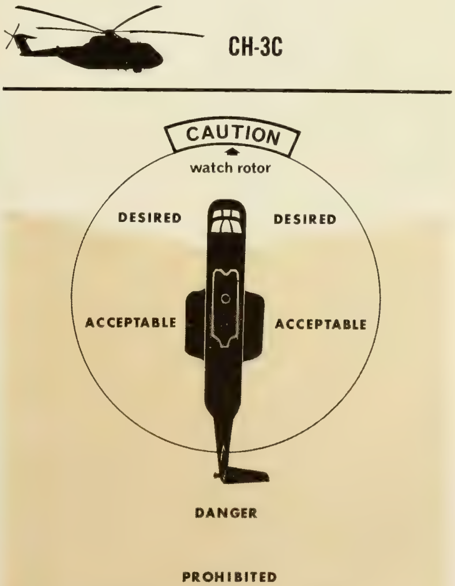
Be sure that personnel in cockpit are aware that you are approaching the aircraft.

CHOPPER ZONES

How do you safely approach a helicopter when it's running? From the front? Rear? Side? Does it make any difference whether the bird is an H-19 or a CH-3C? The editors didn't know and a few cautious questions revealed that there are a lot of others just as ignorant. So we wrote to the helicopter school at Stead AFB, with the results shown on these two pages. Our thanks to Major Donald E. Post, Director of Safety, Hq 3635 Flying Training Wing, Stead AFB, for arranging for this material. As a suggestion, these pages might be posted in a prominent place for all to see. — Ed. ☆



The only authorized approach for other than crewmembers is from directly in front of the HH-43B.



Be sure that personnel in cockpit are aware that you are approaching the aircraft.

It's your Book

Changing the Flight Manual is not difficult. The Chief of the Flight Handbooks Office tells how.

Lt Col Edwin B. Gilmore, ASD, Wright-Patterson AFB, Ohio

I have read with considerable interest (and some slight irritation) several articles which point out weak points in the Flight Manual, or Dash One, of the aircraft being written about.

It is understandable that these weaknesses should creep into, and be pointed out by, the pages of various magazines because the system of submitting Flight Manual "squawks" is not very well known. The fault for this lies, probably, in the office of the Flight Manual Manager. He is being blamed here because he has inserted into the Foreword of every Flight Manual specific directions on how to request changes, ask questions, or obtain other information, and has been naive enough to believe it would be read.

Sometimes, the Flight Manual Manager suspects that the Dash One is considered as a tool to be used by accident investigation boards to assign responsibility for an accident, and by the pilot to find a loophole to avoid that responsibility. After the above loopholes are found, requests arrive for supplements to the manual. A face-saving request received recently, asked that a statement be included in the Dash One to state, in effect, "Do not throw your landing gear safety pins into the jet air intake to preclude damaging the compressor blades." (This warning actually appeared, but worded so as to take out the implication of stupidity).

How do you get your suggestions into the Flight Manual? The last paragraph of the Flight Manual Foreword asks for your comments. You will note that it says "through your command headquarters." This means through channels for coordination. Complaints from the field that have not been coordinated by the various agencies require much study and must be returned to the command channels eventually because, logical as the suggestion is to the reader, the overall mission of the command may be compromised if the change is accepted. The total effect of not submitting through channels is to delay adoption of the suggestion for at least three months. Nevertheless this office still welcomes your remarks. If a unit bypasses normal submission channels consistently, it is reminded of its responsibilities (one such reminder backfired, and we were accused of non-support of our own system). Submission of a squawk to the Dash One does not automatically indicate acceptance for publication.

To sum up: The Flight Manual is YOUR book. Ignore it and it will die, and you may also. If you know where it is weak, tell us, don't spring it on us through the pages of another publication.

AFM 60-1, revised 15 May 1964, contains the latest form for submitting Flight Manual Changes (AF Form 847, which is standard for TAC, PACAF and USAFE and appears in AFM 60-2). We'd prefer the AF Form 847, but we will start acting on any suggestion, no matter what form it is written on, even if it's on a lunch wrapper. ☆

This year, in an effort to get a new angle into the winter hazard story, we went north of the border and searched for tips on winter operations from the pages of the RCAF's Flight Comment magazine, As could be expected, the winter environment reacts similarly on all aircraft, regardless of insignia. Their problems are the same as USAF problems under comparable conditions. But because a review is good for all, and for many provides something new, let's glean away. In the vernacular of the call of the lead character of their bird watcher's corner.

WINTERSFULLOFHAZARDS

WINTERSFULLOFHAZARDS
WINTERSFULLOFHAZARDS

ICED STATIC PORTS

This one the Canadians picked up from TAC's *Attack*.

I had heard that the T-Bird static ports would ice up, but really hadn't given it much thought until today.

We were in it solid all the way down and picked up the usual ice on the windscreen. Nothing serious. GCA picked us up and cleared us to 2500. We leveled at that altitude and 190 knots, picked up the boards. We were getting more ice and I decided we would be better off under the clouds. I asked GCA if they could drop us down a bit. They said they could, and cleared us to 1500. At 1500 we were still in the soup and

CONTINUED ☞

Pilot of CF-101, shown on previous page inverted in snowbank, is removed from aircraft. Crew spent 10 minutes buried in snow before rescue crew got them out.

still picking up ice. GCA told us to descend to 1000 and since I had the gear down by then, I eased the stick forward and reduced power but got no indication of a descent. Nothing changed. Airspeed was steady on about 170 and the altimeter was on 1500.

I knew I was below 1500, but how far below? Even if I'd been expecting this to happen it would've been a shock.

I increased power to 85 per cent to hold the descent and the airspeed jumped to 200 knots. I used the attitude indicator to establish a climb . . . at least I hoped it would be a climb.

Really, thinking back, we didn't have too much of a problem. We had plenty of fuel and our alternate was quite good. I could've climbed back up and gone to my alternate, which is what I was starting to do when I broke out.

FROZEN CONTROLS

A transport was descending to its home base at the completion of a transatlantic flight when the captain noticed the elevator control was becoming progressively stiffer until finally, at 2000 feet, it locked solid. He could control the aircraft using elevator trim but the response, of course, was much slower. Without telling anyone of his problem he decided to land, using trim and power.

Fortunately, the landing turned out OK, but we think he took quite a chance. There is a strong possibility that something could have upset the final approach so that the trim would not have given sufficient or quick enough elevator response to prevent a fatal accident. The aircraft has free-floating controls, and therefore an artificial feel system is incorporated. However, if this system should fail, manual can be selected so that control is not lost. In this case ice in the artificial feel system caused the apparent locking of the elevators and so if this had resulted in a fatal crash, the most diligent accident investigation board would probably never have discovered the cause.

As this incident occurred near home base it is most difficult to understand why the captain did not declare an emergency and request technical advice through the tower. Surely, after a consultation, the aircraft would have been landed with the controls in manual and therefore no unnecessary risk.

INVERTED AT ZERO FEET

Snow plowing had been in progress 12 hours before flight time but considerable drifting from a strong wind retarded clearance. Finally, the north half of the runway (for the full length) was reasonably clear except for windrows of snow. It was decided that this would not seriously hamper takeoff and two sections of CF-101Bs were cleared to go. It was hoped that the runway could be entirely cleared by the time the aircraft returned. However, by the time the first section was on its way back, there was still a ridge of compacted snow about 18 inches high, six to eight feet wide, down the entire length of the runway just south of the centerline. The north side was reasonably clear, but covered with loose snow.

Luckily the first two pilots landed without mishap but the leader experienced a bad skid which he was only just able to control. He advised the tower of the snow ridge with the comment "Just about bought the farm." In spite of this, no action was taken to close the airfield and the second section was not even warned of this extremely hazardous condition.

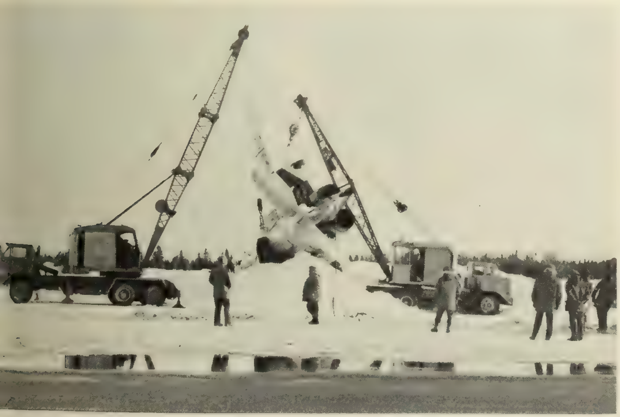
The leader of the next section executed a GCI-GCA to runway 09. With just under 6000 pounds of fuel, he calculated his approach speed to be 190K and touchdown

speed 170K. The aircraft broke out of cloud just after commencing final descent at six miles. The pilot could not distinguish the runway ahead due to a white-out condition. At about 2½ miles the runway became visible and the pilot observed that the north side appeared reasonably clear but was snow covered and that the south side had not been plowed. The aircraft touched down with 4800 pounds of fuel at 170K on the north side of the runway. The pilot immediately deployed the drag chute and the aircraft began to "weathercock" into the 20 mph crosswind which induced a skid to the right towards the center of the runway. He was unable to control the skid and jettisoned the drag chute in an attempt to correct the swing. He then lowered the nosewheel to the runway and tried to control the aircraft with nosewheel steering. However, it was to no avail and the aircraft continued skidding sideways until the right main wheel contacted the snow ridge.

The ridge of snow, acting with considerable force on the right wheel, caused the aircraft to swing around sharply to the right so that the aircraft now began skidding towards the side of the runway, left wing first. The pilot flamed out the engines but could do nothing to control the aircraft. The extreme side loads broke off the nosewheel and then the left main wheel so that the port wing dug into the snow. This caused the aircraft to flip on its back in a five-foot snowbank on the south side of the runway. The navigator noticed the airspeed as 125-135K. The momentum carried the aircraft on its back 150 feet before it finally came to rest, 3300 feet from touchdown.

The pilot and navigator found themselves upside down, uninjured, still strapped in their seats and in total darkness. The cockpit was buried completely in snow but the windscreen and canopy were still intact. The navigator, had the presence of mind to set his stop watch when they first came to rest. It took exactly 5½ minutes for the crash crew to reach the aircraft and start digging in the snow. They broke the canopy with axes and in another five minutes had both the pilot and navigator safely out. The speed and efficiency with which the crash crew worked is indeed commendable.

This rather spectacular accident was assessed "Ground-Air Traffic Control." There was no element of pilot error because the pilot had not been warned of the runway conditions and once the swing started, there was absolutely nothing he could have done to control it. On the other hand, Air Traffic Control personnel who were continually monitoring the snow removal operation were well aware of the runway condition and should have declared the runway unserviceable. ☆



Pilot was not warned of compacted snow ridge on runway. Picture above shows result.

WINTER CHECKLIST

Finally, to wrap up this north of the border report on hazards of winter operations, we reprint a checklist that Flight Comment published last winter.

FLIGHT PLANNING

- Clothing and Survival Equipment.
- Sun Glasses.
- Runway conditions and braking action,
  Base of departure,
  Destination.
- Icing conditions require more power (fuel).
- Check pilot reports.
- NOTAMs on obstructions and hazards.

PREFLIGHT

- Preheat batteries, APU's, engines.
- Airfoils free of ice, snow and frost.
- Static vents and drain holes clear.
- Microswitches free of ice.
- Anti-icing and deicing equipment.
- Ice grip chocks.
- Wheels and brakes not frozen.
- Operate flaps and controls full travel.

GROUND OPERATION

- Ground handling equipment and vehicles clear of the aircraft.
- Oil temperature and pressure limits.
- Taxi slowly-nosewheel steering less effective.
- Avoid throwing slush and snow over aircraft surfaces on runup.
- Watch for sliding during runup.

BEFORE TAKEOFF

- Re-check flight controls—unlocked and full travel.
- Instrument letdown plates available.
- Navigation radios tuned.
- Flight instruments—set for departure procedure.
- Takeoff data—computed for existing conditions.
- Brief crew on departure.

TAKEOFF

- Do not overboost engines.
- Check nose steering after lift-off for indication of frozen strut.
- Exercise wing flaps and gear.
- Make radio calls when safe to do so.

CRUISE

- Operate flight controls and trim tabs periodically.
- Pilot reports on conditions.

APPROACH

- Obtain weather and runway data
  Temperature and braking action.
- Check landing data for actual conditions.
- Brief crew on approach.
- Clear windshield.
- Ask tower for obstruction briefing.
- Cross check altimeters throughout aircraft.
- Copilot call altitudes on descent.

LANDING

- Landing flap setting to prevent slush damage.
- Use reverse thrust judiciously.

PARKING AND SECURING

- Use wing walkers if ramp markings are obscured.
- Taxi cautiously.
- Oil dilution requirements.
- Ice grip chocks in place.
- Release brakes to preclude freezing.

the COLD, COLD FACTS

E. R. Roth, Directorate of Aerospace Safety

The accompanying picture of a Minuteman site expresses better than words the problem of keeping sites sufficiently free of snow and ice during the winter months ahead. By now those responsible should have checked cold weather operating instructions and snow removal plans; reviewed past mishaps caused by adverse winter conditions; assured that proper clothing and equipment is available; and trained personnel in winter hazards and precautionary measures so that accidents will be prevented.

A cross section of previous missile mishaps related to winter season operation and maintenance functions should serve to illustrate what happens when we fail to observe simple precautions. Some of the examples also point out winter type facility design deficiencies.

Minuteman - LGM-30

Instrument air lines from the compressor to the brine chiller moisture accumulator and to the lower level equipment room electrical surge arrester (ESA) area in the launcher have been found blocked with ice. In the former, the moist air in the line froze because the air line was attached directly to the building roof with no insulation between the line and the roof. In the latter, the 45 feet of conduit that contains the air line was buried in the ground above the frost line and sealed at both ends. Proposed actions included lowering the air line in the soft building, removing the caps at both ends of the conduit and removal of ESA panel to permit warm air flow through the conduit. In addition, emphasis was placed on purging water from the drain line as per T.O. 21SM80A-2-7.

Hound Dog - AGM-28B

An airman lost his grip on a wet, icy engine screen; it fell and damaged the leading tip of the nose cone deicer.

While transporting a missile, the trailer slipped into a rut in the snow and struck a Coleman tractor. The exhaust cone had to be removed and replaced.

Falcon - AIM-4A

During transfer of the missile from the coffin to the handling frame, an airman slipped on the ice. As he fell, the missile hit the ramp, denting the stabilizer. In another mishap, the missile slipped from the handling bar back into the handling frame, damaging the fins.

Because of packed snow and ice, the uneven surface conditions contributed to a missile container sliding off the side of a pallet while it was being fork-lifted onto a missile trailer.

Titan I - HGM-25A

Ice and snow were lodged between the antenna door environmental seal, door hinge, and abutment in the trunnion area. The accumulation of the ice was attributed to a lack of positive pressure in the antenna silo (air intake malfunction in the powerhouse). This permitted water to drain into the area and freeze. During the antenna door operation, the environmental seals were dislodged and a large section of concrete broken off.

Atlas F - HGM-16F

Extensive maintenance was being performed in subzero temperatures (—11°F) with the silo doors open for over 24 hours and the missile in the up and locked position. An engine flush and purge was started but could not be completed because the purge cart valves froze. The launch platform was lowered but the silo doors were kept open pending arrival of a re-entry vehicle (RV). Several hours later, subsequent to closing the doors, it was noticed that the chilled water supply and return lines to the pod air conditioner quick disconnects had burst as a result of ice in the lines. Weather limitations were specified for propellant loading exercises (PLX), however, there was no guidance to limit maintenance operations due to the cold factor.

Several Atlas F incidents have been attributed to ice and snow accumulation in silo door hinge pivot well areas:

- During RV installation ice impeded silo door movement preventing it from coasting to the full 95 degree open position. Since the door did not reach the required overbalance position, it began to close slowly and contacted the underside of the MC-1 crane boom. As the door was reopened, the boom separated the RV from the missile. Fortunately, the RV remained attached to its cradle.
- In another mishap, the door

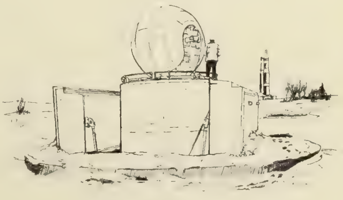
Like this Minuteman site, most missile launch facilities are located in a cold climate which presents a variety of safety problems for missilemen.

angle was deformed while the door was being opened. During door closing, the lip seal channel was stripped and the bolts sheared.

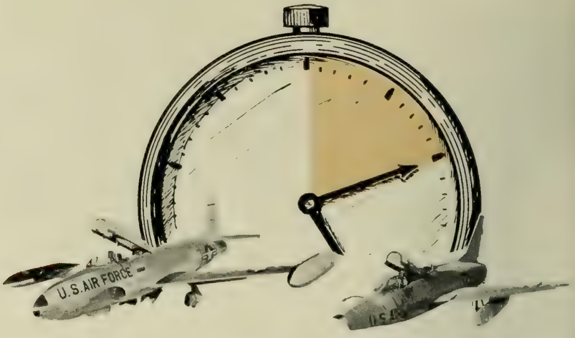
Winter storms can completely bury roads, vehicles, and facilities causing serious personnel hazards. At some locations, maintenance personnel and crews may encounter severe winter weather with temperatures below —20°F and winds exceeding 50 mph. When such emergencies occur, individual ability to survive depends on such factors as: availability of proper equipment and clothing, knowledge of survival techniques, preparation for environmental conditions, physical condition. Emergency rations should be provided as there is the possibility of being temporarily stranded in an underground launch control center (LCC).

The above examples are by no means all inclusive, but they do suggest a number of other-than-normal conditions that require pre-planning to prevent winter accidents. The following list of prewinter reminders may be helpful:

- Review existing snow removal plans. Insure that one individual is completely responsible for snow removal control and availability of equipment. Avoid the use of chemicals to melt snow and ice in the vicinity of launch sites. Chemicals tracked into silos and LCCs can cause corrosion. Use dry sand to prevent slipping hazards.
- Use care in handling smaller missiles (AGMs, AIMs, etc.) or their support equipment on icy surfaces. Take special precautions during lifting (fork lift) and transporting missiles on trailers. Proper tie downs and use of missile covers as specified are also important.
- Do not perform maintenance under conditions that will expose missile facility water lines to freezing temperatures.
- Keep silo doors free of snow and ice. Inspect and clean the door well hinge area prior to activating the door. Properly balance air conditioning systems to preclude moisture being drawn into the silo. Maintain protective covers in good condition.
- Purge air lines and other pneumatic lines to eliminate water, in accordance with T.O. instructions. Route such lines so they do not freeze. Ascertain that underground conduits are buried below the freezing line and that air line moisture removal equipment is located adjacent to instrument air compressors.
- Assure that personnel are warmly dressed; clothing should not restrict movement to the extent that proper job performance is jeopardized.
- Train personnel in winter survival techniques. Assure availability of protective clothing and survival equipment to mobile maintenance teams.
- Establish a plan or scheme for winter season operation to assure that an organized system is readily available to help personnel under other than normal conditions. ☆



TWO in TEN



From an essay by a student safety officer, Flying Safety Officer Course, Univ. of Southern Calif.

It was a cold, wintry, February day at an upper midwestern municipal airport. The average annual snowfall in that part of the country is around 40 to 45 inches. However, the winter was a very unusual one and the snowfall had already reached well over 60 inches. In the previous week, there had been six inches of snow which did not get removed prior to some aircraft landings and quite a bit of vehicular traffic. As it turned out, when the snow removal crews did get to work on it there was a layer of ice and snow firmly packed on the runways.

The two runways concerned here were Runway 35, 150 feet wide and 6600 feet long with no overruns, and 31, 150 feet wide and 9000 feet long with 1000-foot overruns on each end. Since the airport was municipally operated, it was maintained by civilian personnel. Their equipment consisted of some excess plows and blowers which were given to the city by the USAF when they moved off the airport several years earlier. Consequently the machines were not in the best of shape.

One day I was assigned a T-33 transition ride with a pilot who had not flown in over two years. He was new to our squadron and I was given the job of checking him out. Bob had arrived at operations at about 1000 hours that morning and after the coffee and bull session we started to brief for a 1400 takeoff. Due to the runway condition I had changed the mission to instruments. He had only two previous rides in the front seat and I didn't feel that these were the type of conditions in which we should be shooting landings. Because of bad weather around the area, I had decided we would stay in the local area and practice instrument departures and recoveries. With a full fuel load we could get four or five approaches and still have enough fuel to make it to an alternate if necessary.

Because of the very poor braking action, we would be the only ones airborne from the squadron. I say very poor in reference to the U.E. aircraft which were F-100C's. I don't recall at this time what the stopping distance for a T-33 would be under these conditions, but the 9000-foot runway was very adequate. However, to stop an F-100C with ice and snow on the runway requires 7000 feet if the drag chute works, and 9800 feet if it doesn't! The length of the runway left no room for errors. Fortunately we weren't too far behind on training requirements, so felt it wise to cancel F-100 flying for the day.

At about 1300 I called the weatherman and he assured, as best he could, that the weather would remain good with a 3000- to 4000-foot ceiling and no less than five miles visibility at the worst. This would be in snow showers and for short duration. I copied his forecast and filed a clearance with the local FAA Tower.

At about 1340 I was cranked up and ready to taxi. I called the tower for taxi and takeoff instructions and my ATC clearance. I was cleared as filed and instructed by the Center to remain on local approach at all times. The takeoff runway was 13 and I was cleared from the squadron area up Runway 31 into position. This gave me the opportunity to taxi the full length of the runway and see the condition it was in.

As I taxied northwest I noticed high snow banks on both sides of the runway but thought no more about them. I continued on up the runway and was cleared into position to hold and advise when ready for departure. A few moments later I was cleared for takeoff and started my takeoff roll.

We broke ground at the right distance and were soon in the weather and climbing to VFR conditions on top. We broke out at 12,000 feet and continued our climb to 20,000. By the time we reached 20,000 feet, we had been cleared right back down on a standard VOR penetration and an ILS approach. Everything was uneventful and as we executed our approach we were cleared back to VFR on top. The weather had been just as the forecaster had said so we were given approval for another penetration.

This time everything seemed the same except that in the penetration turn I noted that the ceiling had lowered 800 - 1000 feet and a snow shower was just a little further out. I couldn't tell the direction of its movement but I wasn't too concerned anyhow. After we made another missed approach and were climbing out, I heard "Stagger 13" call in for a penetration and landing instructions. "Stagger 13" was an F-100 that had been stuck at an alternate for about five days due to the weather and runway conditions. After I took off he called and asked whether he should come home or wait a little longer. The decision was made to take a calculated risk and let him come home.

The aircraft was due to go to IRAN and the maintenance officer was a little anxious to get it home.

"Stagger 13" was cleared for a penetration and approach to Runway 31. The weather was 3000 overcast and 10 miles visibility and the wind was northwest at 10 knots. "Stagger 13" penetrated and broke out underneath at 3000 feet and had to fly VFR to burn out fuel prior to landing.

I was then cleared for a penetration. As we got below the clouds this time we decided to stay VFR underneath and shoot ILS approaches. During the penetration I noted that the snow was becoming more general and that it appeared to be all around the area. As I reported this to the tower, they told me that it was snowing very lightly at the field also.

I was getting light on fuel and decided to go ahead and land. I called the tower and was given Runway 31. I turned initial a few minutes later and as I turned base I was broken out of traffic for a light airplane. I took it around and on the go noticed that it had started snowing quite a bit harder. As I was on the go, the tower gave me Runway 35 with instructions to expedite and let the F-100 in on Runway 31. I thought for a moment and said I would accept 35. I turned initial, broke and reported on base leg with "gear, brakes and pressure." I knew that, since Runway 35 was only 6600 feet long, I would have to be accurate on my touchdown point. I was shooting for the first 500 feet. The snow in the final approach area was about six to 10 inches deep about a mile out and rose to 39 inches at the approach end of the runway.

During the snow removal process, apparently no thought was given to the overrun or approach area.

As I turned final and started to let down, I could not see the change in depth of the snow. Just after I felt the throttle hit the stop and I had settled down to the job of landing, I felt a tremendous thud and was thrown against the shoulder straps. The next thing I realized the aircraft was sliding down the runway minus the nose gear. Fortunately there were no injuries to either of us other than a strained neck for me.

I got the engine shut down and was out of the aircraft by the time the emergency equipment arrived. The pilot in the back seat was also out and shaken up just a little. The flight surgeon arrived and was putting us in the ambulance for the trip to the hospital and the normal post accident checkup when the F-100 was turning final for his landing on Runway 31. We stood there and watched, because at best we knew he would experience a *little* difficulty due to the runway condition.

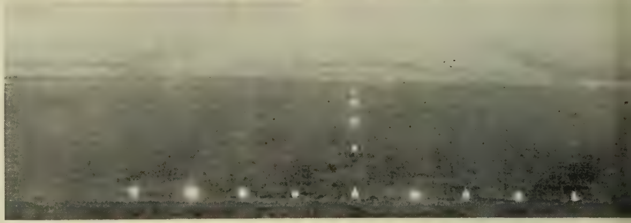
As he rounded out he looked good from our position; however, the same thing happened to him that had happened to me. His depth perception played tricks on him and the next thing we saw was what appeared to be an explosion in the snow. It was the F-100 hitting 325 feet short in two feet of snow. He slid 8000 feet straight down the runway minus a nose gear.

This sequence of events happened over a 10-minute period, thus it was entitled "2 in 10."

Some of the things that were brought out in the accident investigations were that we should not be so complacent about the snow, even though we deal with it for about five months out of the year. Second, maybe a closer look at our snow removal procedures was in order, and third, don't let get-home-itis get the best of us. ☆

An Air Weather Service specialist explains why we need

APPROACH ZONE PIREPS



Maj Wilson V. Palmore, Air Weather Service

"A pilot will make inflight reports to the appropriate agency (approach control, GCA, or tower) when an IFR approach is made to an airfield and the weather conditions are noted to be below minimums or to differ appreciably from the last official observation received. Reports will include an estimated value of conditions encountered, which will be immediately sent to the weather station by the receiving agency." So reads paragraph 29b of AFR 60-16A.

Presently, surface observations are taken at a fixed point on an airdrome. At USAF bases the observing point is selected to give the best possible view of conditions pilots will encounter on the approach. Observing instruments have been located in approach zones and beside runways to give representative observations. (At most USAF bases equipment for measuring ceilings, visibility and surface wind are located at the approach end of each runway with precision approach.) Air Weather Service has made much progress to improve quality and quantity of surface observations. At present the entire function is being reviewed to improve observing procedures to present a more realistic observation to pilots for landings.

With all the advancements, the conditions encountered by a pilot making an approach may differ from the conditions reported to him. Why? There are numerous reasons: rapidly changing weather conditions, limitations of observing equipment, human limitations in interpreting instrument readouts, variability of conditions around an airdrome, slant range visibility as observed by the pilot vs. horizontal visibility measured on the ground, and restrictions to pilot's vision caused by windscreen construction, especially when exposed to snow or rain. Because of these factors, the pilot making an approach is in the best position to report the weather conditions in the approach zone. This is why pilot reports are required.

The approach zone PIREP satisfies two needs. It helps the weather observer and other pilots. Here is an actual case. The weather wasn't too bad for a European base — 800 foot ceilings and visibility two miles restricted by fog and drizzle. Two fighters were upstairs waiting to penetrate. Number one came down all right. Number two broke out to the left of the runway, tried a quick "S" turn, did not level soon enough and damaged the aircraft.

During the investigation the lead pilot said that during his approach he almost went around because his effective ceiling and visibility were not as reported. However, at the time, no PIREP was given. Other pilots said the same thing — at the investigation — but not during the actual situation.

From post analysis it appeared that the surface observations were accurate. The conditions were lower in the approach zone. This information would have been most valuable to the number two pilot.

You will note that the approach zone PIREP should be given to the appropriate agency controlling the approach. In this manner they can immediately pass the word to other pilots awaiting an approach. The controllers are then required to pass the word to the weather station.

Other sub-paragraphs of 29 require PIREPs under other circumstances. At this time we only want to clarify one other problem area. When making an approach your PIREP should be made to the controlling agency; after landing talk it over with the forecaster. In flight, your reports should be made to a forecaster over PFSV or to an FSS. These two agencies can enter PIREPs into weather teletype networks. It is not a duty of ARTC personnel to collect or transmit PIREPs. If they receive a PIREP and have time they must call the report to a Weather Bureau or FSS facility before the report can be entered on the weather network. ☆

False Security

Lt Col Garn Harward, USAFE

How many times have you received a route weather briefing like this? "Generally good weather can be expected for route of flight except for an area of a few thunderstorms."

You accept this weather picture with glee and proceed enroute on an IFR flight plan. The FAA Air Traffic Control Center keeps close tab on your whereabouts to insure that you will not meet another IFR flying machine coming in the opposite direction. Provided your aircraft is above all the rock-filled clouds, about the only hazards you are likely to encounter are birds, areas of severe turbulence, or thunderstorms with hail.

Are we, as pilots, becoming too complacent about enroute weather while under the control of ARTC? Do we fully understand the primary responsibility of FAA Air Traffic Control and their capability for vectoring aircraft around or through areas of weather hazardous to flight?

Examine with me a recent acci- lent in which the aircraft disintegrated as a result of severe turbu- ence with a loss of all personnel board.

The pilot had received the weather briefing as stated above. The APS-42 airborne radar was inoperative; however, based on the forecast weather, this would not ground the aircraft, which departed on an IFR flight plan during the hours of darkness and under the control of ARTC. (Thirty minutes prior to he accident the Weather Bureau ssued a severe weather warning which was broadcast over the VOR tations. It is not known whether he pilot heard this broadcast.) When the pilot requested informa- ion from ARTC concerning possi- le thunderstorm activity, he was dvised of some precipitation to the ast of his position. However, the ntensity of the precipitation was nknown. When he reported "heavy recipitation and moderate turbu- ence" a clearance was approved to ivert off course around the storm rea. The Center replied that the ircraft was evidently encountering omething not observed on the FAA adar scope.

We know the results: total dis- ntegration of the aircraft. We im- nediately ask, could this accident ave been avoided? And many other uestions such as, what is the responsibility of ARTC? Was the severe weather area known to anyone? If so, why wasn't the aircraft vectored around it. Did the pilot query Air Force Metro on en route weather conditions? Did the pilot monitor en route weather broadcasts?

The normal and accepted procedures of ARTC radar identification and subsequent radar vectoring to circumnavigate storm areas encourage pilots to reply almost completely on the ARTC radar. However, even though various FAA control facilities are equipped with radar they may not have the capability or be in a position to *provide assistance* for circumnavigation of a severe weather area. That FAA is not *primarily* responsible for vectoring aircraft away from severe weather areas may come as a shock to most pilots. (Note: Air Traffic Control agencies are not required to utilize their radar in the normal mode which will paint most areas of heavy precipitation. Normally, in order to better control traffic, radar is used in the beacon mode; therefore, pilots must realize that weather conditions may not be known by the controller. Pilots must not become apathetic and assume that their aircraft will be vectored around thunderstorms along their route of flight.) The weather information relayed to the pilot by ARTC is based on inflight reports from pilots, Weather Bureau forecasts and radar, which detects only the heaviest precipitation areas.

FAA has the primary responsibility for control of all aircraft on IFR flight plans and also to advise pilots of *known* or forecast severe weather. As a secondary function, it also provides assistance for circumnavigation of severe weather areas when they are *known* to the controller. Due to the limitation of the control center radar in identifying severe weather areas and the primary responsibility of aircraft separation, weather advisories through this medium will not always provide the pilot with the actual weather picture along his route of flight. Until such time as all controlling agencies have the radar capability and/or effect the necessary coordination for advising the pilot of a hazardous weather condition, aircrews must:

- Monitor the scheduled weather broadcasts on FAA stations;
- Request the controller to keep them advised of any severe weather;
- Query the nearest Air Force Metro for an up-to-date weather briefing along the route;
- If a visual observance indicates a severe weather condition, take an alternate route or make a 180-degree turn before it is too late.

Under the present system, the primary responsibility for en route weather analysis remains with the pilot. Until such time as the system is changed, weather advisories forwarded by control centers are only as realistic as the Weather Bureau forecast and preceding pilots make them. ☆

Aerobits

EJECTION FROM THE F-102. When an F-102 pilot is confronted with a situation requiring ejection the success of past experience should provide confidence in the reliability of the egress system. With the realization that we do not have a zero-zero capability, even with the present rocket catapult (installed in some aircraft), the following F/TF-102 ejection experience is significant.

Year	F/TF-102 Ejections	Number Successful
1957	6	5
1958	8	7
1959	14	13
1960	8	6
1961	15	14
1962	19	18
1963	18	14
1964 (6 mos)	4	4
Total:	92	81

The definition of a successful ejection as used in the above tabulation is an ejection that does not result in a fatality. With this fact in mind, a look at the 11 fatal ejections during this seven and one-half year period reveals the reliability and capability of the system.

The 11 fatal ejections were as follows:

Eight pilots attempted ejection at or below 500 feet and were fatally injured.

One pilot ejected between 500 - 600 feet, but did not separate from the seat since the lap belt failed to open.

One pilot ejected at 8000 feet but was drowned at sea.

One pilot ejected above 5000 feet at high speed in a near vertical dive and was fatally injured — probably as a result of being struck by the seat.

The conclusions are obvious — if you have sufficient altitude when you eject you'll probably be back on alert the next day.

Ejection experience of those F-102 aircraft equipped with rocket catapults reveals essentially the same success rate as that of ballistic catapults. Twelve of the 92 ejections were made via rocket catapult. Ten of these were succssful. The two unsuccessful attempts were made below 500 feet and are included in the figures shown above.

There have been some questions regarding rocket catapult ejections in the TF and the possibility of burns sustained by the second pilot to leave the aircraft. Our records show that one TF equipped with rocket seats has been successfully abandoned in flight. The second crewmember to eject was not adversely affected by the rocket blast of the first seat.

This brief summary of ejection experience again emphasizes the necessity of not delaying a decision to eject. At least 2000 feet above the terrain is MINIMUM recommended ejection altitude when conditions permit. (Controlled emergency above 2000 feet.)

Engine failure on takeoff or on final, however, will not necessarily allow this comfortable 2000 feet minimum ejection altitude. The decision to eject in a situation such as this depends on the varied circumstances at hand. The success rate for ejection from the F/TF 102 at or below 500 feet reveals that 13 pilots have tried it and only five have been successful. Tests and some actual ejection experience have shown that successful on-the-runway ejection is possible with a 120 knot forward speed. However, it must be emphasized that this is predicated upon ideal conditions of flight such as the aforementioned forward speed, proper aircraft attitude and proper functioning of *all* components of the escape system. When a choice of ejecting at higher altitude is available, it is totally unrealistic to delay the decision in order to comply with the emergency minimums in the Dash One.

A high impulse rocket catapult is presently under consideration for installation in all F-102 aircraft. We are lending full support to this program; however, until such time as F-102's are equipped with a proven zero-zero system, the emergency minimums stated in the Dash One are, and must be, considered a last resort measure.

Capt Vernon G. Knourek
Directorate of Aerospace Safety

BE WELL-DRESSED. The average Air Force pilot is a pretty well-dressed guy. He spends lots of money to maintain a good-looking uniform for all occasions and in addition, maintains a complete set of civilian clothes for off-duty wear. Another complete set of clothes is provided by the Air Force for wear while flying.

It seems a real shame, then, that some of us refuse to be properly dressed for the occasion. Oh, I'm not referring to the Mess Dress required for certain formal occasions. No officer would ever show up out-of-uniform for a Dining-in. He wouldn't run the risk of an on-the-carpet chewing by the Old Man. But if he were to show up improperly clothed for flying it could be much worse — it could be his life.

Illogical as it would seem, it's done.

An Air Force pilot from one of our northern bases is still missing as a result of an accident in which the other crewmember spent 14 hours in a survival situation in snow-covered rugged terrain prior to rescue. The accident report states the missing pilot was not properly dressed to allow himself maximum protection under arctic conditions.

Regardless of the reason, whether it be lack of action on the part of supply personnel, personal equipment types or your commander, or simple individual carelessness — it would be a shame to lose your life because you were not "well-dressed."

Major William R. Detrick
Directorate of Aerospace Safety

AIR MOISTURE vs. ENGINE THRUST . . . Controversy sometimes arises as to whether more jet engine thrust can be obtained from moist ambient air or dry ambient air. The answer can be found by comparing the molecular weight of dry air and water vapor. According to Avogadro's hypothesis, a fixed volume of gas entering the engine inlet *at a constant temperature and pressure* will contain the same number of molecules regardless of the chemical composition of the gas. Because the molecular weights of water vapor and dry air are approximately 18 and 29 respectively, it can be seen that the greater the percentage of dry air, the heavier the inlet air will be. Since thrust increases with air density, more thrust can be obtained from a given volume of airflow on a dry day than on a humid day.

A question may also arise as to why water injection on the J57 engine increases engine thrust on a warm day.

On a hot day at a given throttle setting essentially the same volume of air will enter the engine as on a cold day. However, the decreased density of the air causes a loss in weight (mass) flow through the engine. To compensate for the reduced density of the air and corresponding thrust loss, water is injected into the engine during takeoff and initial climbout. The vaporization of water cools the air and increases its density. For a given volume of air a greater mass is therefore possible. More and cooler air entering the burner section permits more fuel to be burned before the maximum allowable temperature in the turbine section is reached. The combination of greater air mass and added fuel flow increases thrust.

Boeing Service News, Issue 286
July-August 1964

Aerobits

WHICH WAY DID THE RUNWAY GO? — As practically any pilot knows, a white concrete runway set in a surrounding of green grass and trees will stick out like a sore thumb. If the weather is clear with 50 miles visibility, even the old folks can dispense with bifocals to find the landing strip. But, what if a runway is surrounded by snow covered terrain, or is located in sandy desert area, or is a narrow asphalt strip located in dark green surroundings and the visibility is poor? Under these circumstances many airfields have runways which are hard to see all or part of the time, and the problem gets worse when an approach is made into a rising or setting sun.

Standard runway and approach lighting systems help to solve the runway recognition problem at night, but in broad daylight, when visibility is less than optimum, finding the runway can be rather difficult. It is not hard to find reports of pilots landing on a taxiway or on the ramp because of mistaken identity.

Is there a positive solution to this problem? The answer must be no; however, a suggestion, which has been tried with good results, is the use of strobe lights in daylight. A large number of military and civil airfields have been equipped with strobe light systems. They may have one or two flashing strobe lights at the approach end of a runway, or a much more sophisticated system of sequenced strobe lights that flash a path toward the runway threshold. If these lights are operated during daylight for some of the hard-to-see runways, pilots will be relieved of some of the mental burden involved in getting their airplanes safely back on the ground. The result may well be the prevention of an accident. The use of every aid to find a runway is essential, regardless of whether it is day or night, clear or cloudy. The cost of operating strobe lights is negligible when equated against prevention of an accident. TRY IT BEFORE YOU SAY NO!

Lt Col I. D. Rothwell
Directorate of Aerospace Safety

EXCHANGE OFFICER HONORED — A USAF pilot, Captain R. A. Burpee, has been honored with a "Good Show" in the RCAF safety magazine, Flight Comment, for his performance during a T-33 emergency. While giving a routine T-33 checkout, and on go-around from an instrument approach, a loud bang was heard, accompanied by severe vibration. Altitude was approximately 50 feet, airspeed was 140 knots, and the aircraft was just passing the upwind end of the runway. Captain Burpee took control, declared an emergency and nursed the aircraft into a gentle climbing turn, aiming for a low key position from which they could either bail out or make a forced landing. Captain Burpee was able to land the aircraft and investigators found that a piece of broken guide vane had caused considerable internal damage. ☆

Maj Robert D. Hale, Director, Operations
USAF Central Coordinating Staff — Canada
Ottawa, Ontario, Canada

WELL DONE

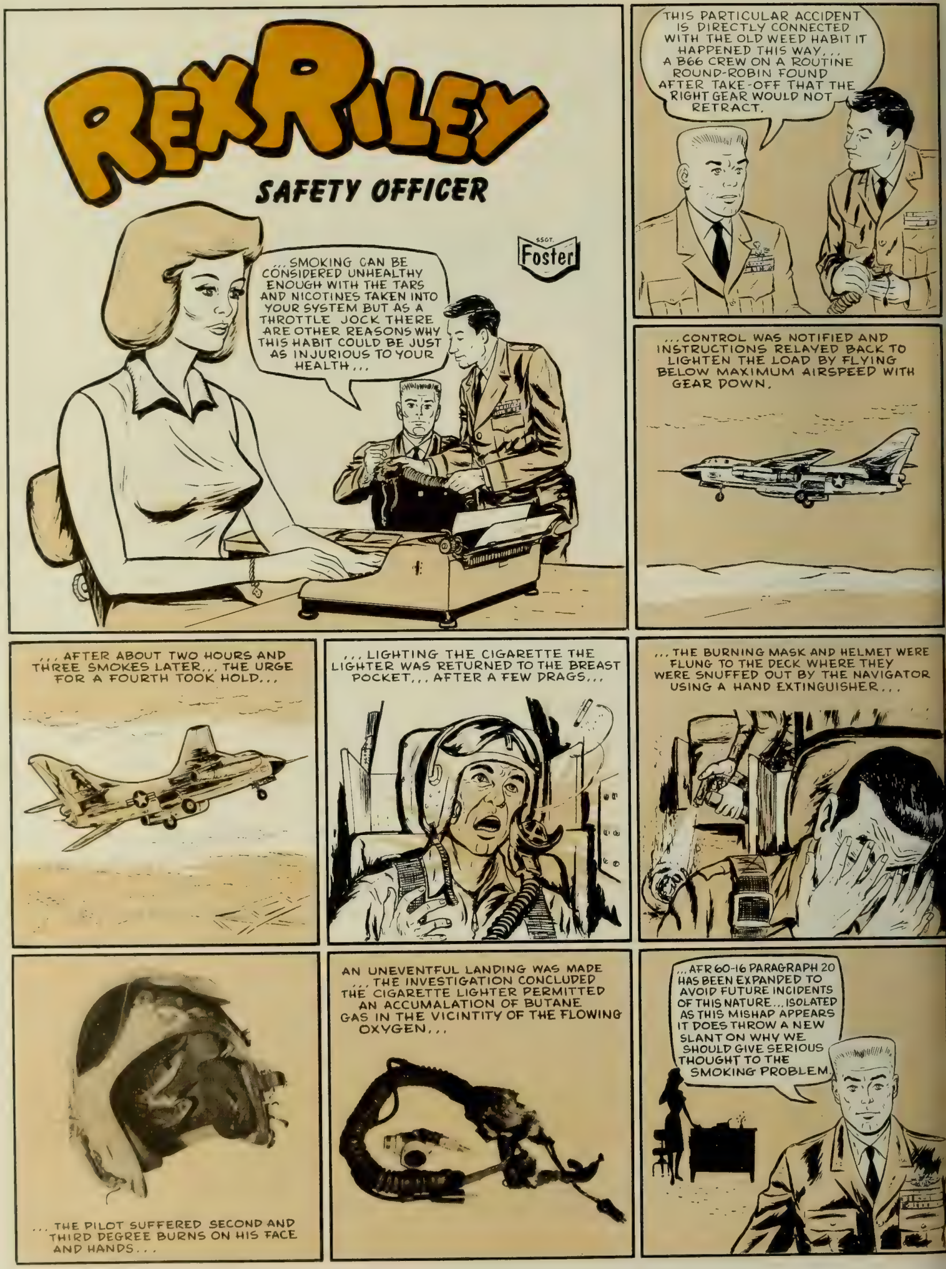
CAPT. ALAN L. LOMAX

318 FIGHTER INTERCEPTOR SQUADRON,

Captain Lomax departed McChord AFB on a low altitude intercept training mission. After completion of the final intercept, a climb was initiated to VFR on top with 3200 pounds of fuel remaining. Shortly thereafter he tried to trim out left aileron pressure and found that the aircraft did not respond to trim nor was he able to correct a right roll with normal stick force. Hydraulic pressures were 2900 pounds primary, 3300 pounds secondary. The use of both hands was required to prevent right roll while stick movement in other directions had no feel force. Then the control stick and flight controls began random movement as if someone were cycling the control rods in the engine bay. As the random flight control movement continued, stick movement aft of neutral became restricted. Captain Lomax could maintain level flight only by terrific force with both hands and then only for a short period since the force required rapidly fatigued his arm muscles. By removing one hand intermittently from the control stick and allowing some right roll to continue he was able to retard the throttle and reduce airspeed to 230 knots at 32,000 feet.

When different modes of operation were attempted with no affect, Captain Lomax left the mode switch in direct manual position and decided to attempt a landing at McChord. The aircraft seemed slightly more controllable as speed was reduced, although the oscillations continued for the duration of the flight and extreme stick forces persisted. When 50 miles from station speed boards were extended (with no affect on oscillations) and a reasonably controlled descent set up. Weather was 5500 feet broken with five miles visibility in rain. After breaking out of the overcast at 5500 feet he extended the gear normally and slowed to final approach airspeed for a simulated landing. He then determined that he had control enough to attempt a landing.

A right hand base leg was initiated four miles from the runway and different speeds and power manipulations were made in an effort to obtain a landing attitude. Captain Lomax was unable to get all the up elevator action needed, however, he was able to make a satisfactory landing and touched down 1500 feet down the runway. Captain Lomax's judgment and analysis of the situation saved a highly potent weapon system. Well Done! ☆


REX RILEY
SAFETY OFFICER
SSGT. Foster
...SMOKING CAN BE CONSIDERED UNHEALTHY ENOUGH WITH THE TARS AND NICOTINES TAKEN INTO YOUR SYSTEM BUT AS A THROTTLE JOCK THERE ARE OTHER REASONS WHY THIS HABIT COULD BE JUST AS INJURIOUS TO YOUR HEALTH...
THIS PARTICULAR ACCIDENT IS DIRECTLY CONNECTED WITH THE OLD WEED HABIT IT HAPPENED THIS WAY... A B66 CREW ON A ROUTINE ROUND-ROBIN FOUND AFTER TAKE-OFF THAT THE RIGHT GEAR WOULD NOT RETRACT.
...CONTROL WAS NOTIFIED AND INSTRUCTIONS RELAYED BACK TO LIGHTEN THE LOAD BY FLYING BELOW MAXIMUM AIRSPEED WITH GEAR DOWN.
...AFTER ABOUT TWO HOURS AND THREE SMOKES LATER... THE URGE FOR A FOURTH TOOK HOLD...
...LIGHTING THE CIGARETTE THE LIGHTER WAS RETURNED TO THE BREAST POCKET... AFTER A FEW DRAGS...
...THE BURNING MASK AND HELMET WERE FLUNG TO THE DECK WHERE THEY WERE SNUFFED OUT BY THE NAVIGATOR USING A HAND EXTINGUISHER...
...THE PILOT SUFFERED SECOND AND THIRD DEGREE BURNS ON HIS FACE AND HANDS...
AN UNEVENTFUL LANDING WAS MADE ...THE INVESTIGATION CONCLUDED THE CIGARETTE LIGHTER PERMITTED AN ACCUMALATION OF BUTANE GAS IN THE VICINTITY OF THE FLOWING OXYGEN...
...AFR 60-16 PARAGRAPH 20 HAS BEEN EXPANDED TO AVOID FUTURE INCIDENTS OF THIS NATURE... ISOLATED AS THIS MISHAP APPEARS IT DOES THROW A NEW SLANT ON WHY WE SHOULD GIVE SERIOUS THOUGHT TO THE SMOKING PROBLEM.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1964 751-211/2

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

DECEMBER 1964

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AEROSPACE SAFETY

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AFRP 62-1 DECEMBER 1964 VOLUME 20 NUMBER 12

FALLOUT

AFM 127-100

Publicity of the fact that AFM 127-100, dated 20 Apr 64, has superseded AFM 32-6, seems to have by-passed some very important people. The back cover of the October issue of AEROSPACE SAFETY lists AFM 32-6 as the first reference to check, regarding grounding. The article "Is Your Safety Program Effective," in the Sept-Oct 1964 MSO Kit, lists AFM 32-6 as a principal source of guidance. Also listed is AFM 127-100.

Suggest future publications be screened to eliminate reference to outdated and superseded publications. We in the field depend on your publications to keep us informed on the latest developments.

Keep up the good work.

Capt Harvey R. Searle
NSO, 1611 Air Trnsp Wg
McGuire AFB, N. J.

The Captain is correct. Explosives Safety Manual is now AFM 127-100.

COMMUNICATIONS CHATTER

Everyone complains about radio chatter—as they do the weather—but no one does anything about it. We all know we cannot control the weather. Not yet, anyway, but we can sure put our own self control on radio chatter.

When you flight plan, have the radio frequencies for departure, enroute and letdown. Departure frequencies are listed in the Enroute Supplement and SID's. Operations should have the latest changes. Enroute radio stations and discrete frequencies are in the Enroute Supplement. Arrival frequencies are in the Enroute Supplement and on the letdown plates. Monitor the controlling frequencies at all times—the controller might be working more than one frequency. You will not only hear his transmissions, but also other aircraft on your frequency. If you have to leave frequency for any reason, let the controlling agency know when you leave and when you are back on. Know which calls are mandatory. Give the required information and not a life story. Know what you are going to say before punching the mike button; write it out if you have to. If instructions are understood, there is no need for read-back, except for clearances.

If everyone cooperates, both ATC's and crewmembers' work will be safer and simpler.

Capt Allen J. Monroe
Hq Amarillo Tech Tng Ctr
Amarillo AFB, Tex

HIGHWAY SAFETY

I like the approach in the article entitled "Declare War," by Major Clifford J. Galliot (May 1964). He has a message well worth heeding. After mulling over the subject of National Driving Standards for sometime, I wrote a letter to Senator Everett Dirksen presenting these four recommendations as a proposed solution to reduce the carnage on our nation's highways:

1. Let's educate all of our licensed drivers and potential drivers on the complete responsibilities of a vehicle operator when he seats himself behind the wheel. A vehicle is a lethal weapon when improperly operated, just like a gun, and this fact must be stressed.

2. Let's physically and mentally examine our potential drivers on a yearly basis to

continued on page 28

AN EDITORIAL FORETHOUGHT ON . . .

RESPONSIBILITY

Ability and readiness to assume responsibility are essential traits of the military pilot, traits he must demonstrate repeatedly. Consider the interceptor pilot who scrambles in the middle of the night. He receives assistance via radio and is followed on radar, but he alone must interpret the many instruments in his cockpit and react accordingly. Or, take the bomber crew commander who is responsible for performing a long, exacting mission and for integrating the efforts of his entire crew. The 27-year-old lieutenant who commands the transoceanic flight of a transport loaded with troops faces up to a responsibility much different than if he had chosen to be a banker, a lawyer or manager of a local store. And their counterpart, a captain sitting 60 feet underground in a ballistic missile launch control room, has a responsibility that belies comparison.

For the well trained, most decisions are clear cut. But occasionally decisions that must be made in fulfilling responsibility are most difficult. A situation may be marginal and the individual in command of the aircraft or the launch control center, or possibly another commander passing directions from a remote site, may knowingly or unknowingly take a chance. If this happens often enough and supervisors fail to stop such practice, the law of averages catches up. An accident results.

Responsibility is a rare trust, and it comes as the reward for study, practice and demonstrated maturity, not necessarily in years but in proven performance.

Sometimes this responsibility reaches heights that shine as examples for all and reflect the greatest possible credit on the Air Force. Late last spring a 26-year-old Air Force pilot, desperately attempting to avoid a housing area, stayed with his fighter as it lost power after takeoff. When he had done all that was humanly possible, he ejected, but he was at ground level. He paid for this example of assumption of total responsibility with his life.

Considered in the light of dollars received for such services, the responsibility seems way out of line. But other rewards, not as definable as dollars, are much greater. The knowledge that a job has been done right is reason for just pride. The importance of making correct decisions reaches the ultimate when the penalty for mistakes can be fatal.

These real values far transcend mere monetary award. They add up to the satisfaction that comes from responsibility fulfilled. They are rarely fully appreciated except by those to whom such responsibility has been entrusted. They are given to the capable, and only after demanding apprenticeship. There are key command slots for but a few, and only those who have demonstrated the willingness and ability to accept responsibility make the grade.

The Air Force, by its very mission, opens wide the door to individual responsibility. Only the best can measure up.

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

FIRST TH

This morning when I arrived at work I was greeted by an old friend who had been assigned recently to command an F-100 wing. After a brief hello, how-are-you, he said, "My new wing has a well-established formal safety program, an effective working safety council, and a snoopy safety officer who's constantly looking for hazards around the air patch. In fact, safety-wise, the outfit looks pretty good; however, if the command were yours, what would be the first areas of concern you would attack in order to avoid accidents?"

Since all F-100 accident reports, incident reports and unsatisfactory reports flow across my desk like wine at an Italian wedding, and the safety record of the F-100 has been my main concern for eons, the question was most aptly aimed. Strangely enough, the answer as to what to do and where to start is simple; *how* to accomplish all the objectives and to maintain interest in the program is more complex and differs from wing to wing. I'm not going to try and solve all the problems, I'll simply try to point out where the least effort can provide the most immediate results.

F-100 accidents and incidents are not confined to one or two problem areas. However, the majority can be prevented or minimized by concentrating on six main accident potentials: flight control/auto pilot maintenance, gyro horizon maintenance, air-to-ground range discipline and delivery techniques, recognition of pre-stall warning and proper techniques for recovery from post-stall phenomena, weather letdown and landing procedures, and pilot pre-takeoff go-no-go instrument recording. Since pilot fatalities per major accident are directly proportionate to the proximity of flight to good old Mother Earth and since F-100 duties call for a great deal of flying near the ground, a concerted effort is necessary to insure thorough pilot knowledge of emergency procedures. This includes ejection techniques.

First things first: pilots are taking off in aircraft that poop out during the takeoff roll, shortly after breaking ground or during initial climbout. Many of these accidents can be prevented by insisting that all pilots record seven vital instrument readings during the pre-takeoff phase and the same seven recordings prior to departing the immediate area of the takeoff airfield. EGT, EPR, RPM, fuel flow, oil pressure, flight control hydraulic pressure and DC/AC output should be recorded during taxi out and immediately prior to brake release. EGT, EPR and RPM readings should be read, and must show normal indications at the acceleration check point, otherwise abort the takeoff. The last check is made as climb speed is established and includes the same readings made prior to brake release. Further, the habit of glancing at the advisory light panel at these critical moments is not universal. On many occasions, pilots have stated that they were unaware of the length of time of illumination of caution lights, especially when flying in formation or in weather.

Most pilots say that they do read all important gages prior to take off. Many do, some don't. A wing operating procedure to insure that these recordings are made, motivation to stress the importance, and complete elimination of complacency concerning fluctuating instruments and "almost normal" indications is a must. Either the recording is in the green or an abort is indicated. Not many operational commitments dictate a necessity for going with aircraft that border on sick. In addition to minimizing takeoff accidents, maintenance personnel will be provided with information that is invaluable. Some pilots may resist recording and say that reading the indications and properly reacting to them will serve the purpose. Also, they say, recording is difficult in formation or in weather. They are correct; however, proper recording establishes the habit of accurately reading each indication every time rather than scanning some of the indications some of the time.

The next area for concentration would be maintenance. Unexplained accidents involving peculiar maneuvers on the gunnery ranges, spins, stalls and wild gyrations during night and weather flying, and erroneous movements of control surfaces highlight fertile areas for maintenance efforts: proper maintenance of the autopilot flight control system, constant exercise of the autopilot and proper maintenance and handling of the gyro flight indicators. All pilot write-ups must be cleared by realistic and aggressive maintenance. Too often flight control difficulties are extremely hard to pinpoint. As a result, minor flaws found during the investigation are fixed, yet, the fix often has no direct bearing on the write-up. Consequently, the pilot's initial write-up is repeated, or, as has happened, results in an accident at a later date directly attributable to the initial write-up not being cleared. The key point on flight control maintenance is that it must be a team effort: i.e., mechanical, electrical, hydraulic, etc. Gyro instruments must be monitored constantly and when smal

IGS FIRST

Maj Eugene P. Sonnenberg, Directorate of Aerospace Safety

deficiencies appear, they must be corrected. Deficient MM-3 gyros have been suspected in several recent fatal accidents. An immediate and temporary improvement is compliance with T.O. F-100-825 (Installation of Back-up Attitude Indicator). Gyro reliability is being pursued by the R & D and procurement agencies; however, improvement of attitude indicator reliability is not an overnight task.

Proper maintenance efforts concerning drag chute packing and aircraft drag chute mechanisms can also save a wing commander sleepless nights. One or two failures per one hundred landings is the present norm, any more than that dictates a new look at maintenance procedure in this area. Also, while on maintenance, I'd advise that the first task you assign to the Safety Council be a close examination of the wing technical order backlog. Flight Safety has found that the F-100 backlog is quite heavy and that quite a few T.O.'s with a safety connotation have become lost in the shuffle.

No one wants to make fatal errors, but pilots continue to make them on gunnery ranges. They are flying into the ground on the range and during simulated attack. These accidents are normally the results of trying to salvage poor passes, pressing to achieve hits or operating during marginal weather. Only through careful selection of range control officers, thorough briefing of pilots and disciplining those pilots who repeatedly foul on the ranges can these accidents be minimized. The objective is not to turn tigers into pussy cats by moving them out to a point where effective delivery results cannot be achieved. Rather, it is the improvement of delivery techniques and insistence on recognition and elimination of dangerous practices. Scores will improve and accidents will be prevented.

There is only one way to minimize accidents that result from weather: carefully schedule and use instrument practice periods, then eliminate pilots who don't meet the standards.

Stalls, spins and failure to recognize and recover from adverse yaw take a heavy toll of F-100s each year. The only way to prevent such accidents is to constantly educate pilots on F-100 pre-stall characteristics and recoveries. Repeated showings of films on these phenomena will also help.

If all pilots will remember the following two important facts, half the battle is won.

- The F-100 will not stall with a wing loading of less then one G. Applying forward stick will prevent or eliminate the stall.

- Adverse yaw will not be encountered without application of aileron. Adverse yaw is a function of angle of attack. If the airplane is at an angle of attack where adverse yaw is pronounced, then aileron effectiveness also is reduced and more effective lateral control can be achieved by using dihedral effect (sideslipping with rudder). Normal control can be regained by forward stick.

The important thing to remember is to keep the ailerons neutral and fly with the rudder under high angle of attack flight conditions. Remember that with asymmetric stores installed, some aileron will be trimmed in and neutral stick will not give you neutral ailerons. When a pilot feels he has lost control, his first reaction should be neutral ailerons and forward stick. The horizontal stabilizer is very effective, so it won't take much forward stick to reduce the angle of attack and regain normal control response. Do not confuse angle of attack and attitude. An airplane can be at a high angle of attack in any attitude — even with the nose well below the horizon. The main point to remember when the aircraft becomes momentarily uncontrollable is: don't panic! Then recover in the manner prescribed in the flight manual (permit sufficient time for aerodynamic response). Eject if recovery is not effected.

Last, but certainly not least: Emergency Procedures. Test all pilots on emergency procedures and review. Test — review, test — review!

Cockpit practice and review of emergency procedures under the eagle eyes of flight commanders, operations officers, squadron and wing commanders is a must. Schedule the reviews so that pilots have time to read the good book. Give impromptu tests to insure that pilots are retaining information. Especially check to insure that the pilots are remembering more than just the bold print memory items in the checklist. The checklist is a handy, quick reference guide, but the procedures should be studied from the Flight Manual. There is a world of knowledge there, and it can't all be in bold print.

I admit, wholeheartedly, that nothing new has been advanced here. The aim of this effort is to stimulate F-100 commanders to concentrate on current accident potential areas in the hope that some old friends can be preserved. ☆

Don't Bet On The Lady

It looked pretty good . . . not one of those desperate leaps out of a gyrating bird dead set on boring a hole in the ground. Wings were level, nose straight ahead, slight descent. He was talking to the Center and out there on the left was his wingman.

Now he was below 10,000. Time to go. He got ready, then pulled up to lose speed and ejected at about 8500 feet. From this point on things didn't go so well.

As the chute deployed his right foot got tangled in the shroud lines. Finally he got it free but the chute oscillated somewhat. He broke out under the overcast at about 5000, opened the cover on the right hand riser quick disconnect and prepared to land. He was moving over the ground quite rapidly, and when he hit he was dragged over the edge of a canyon and down the side about 400 feet. With the canopy dragging him through the snow, he tried desperately to release the risers but couldn't get a good grip on the release. Finally, near the edge of a steep cliff, the canopy caught on a tree and his slide down the hillside came to a halt. He was tangled in the shroud lines, some of them wrapped around his neck. Finally, after taking off his helmet, he managed to free himself.

Movement was difficult because of the deep snow, but he finally got a flare out of his survival kit which was lying about 10 feet away. A welcome sight was a light plane circling overhead. No problems now; they'd be out to get him pretty soon. Just get to the top of the hill, so that a pickup could be made. That, however, was easier said than done.

First, he fired the smoke flare to make it easy for the light plane pilot to spot him. It worked just fine; the pilot indicated that he had him. Now to get to the top of the hill. He put the night flare in his pocket, his SARAH beacon inside his flight suit and started climbing. Progress was slow because of the steepness of the slope and the snow. He turned back and left the SARAH with his other gear, the antenna stuck upright in the snow, and sat down to rest. He knew he had to get to the top of the hill but he couldn't see taking all the gear with him. He'd climb up, then if he wasn't picked up by dark he'd return to his survival equipment.

It took almost an hour, with frequent rests, to make the crown of the hill. Hope surged when he saw two choppers and a C-123 join his friend in the light plane. But it was almost dark now. He reached into his pocket to get the flare; it was gone! Somehow he must have lost it during that rough climb up the hill.

In the gathering darkness the rescue aircraft were having a hard time spotting him. He had no way of signaling and had to depend on the crews spotting him from the air—tough in the fading light.

Finally a crewman aboard one of the choppers saw him and he was picked up by sling and returned to base.

Within a scant two hour period this pilot ejected from his aircraft, went through a brief but harrowing experience, was rescued and returned uninjured to his base. Luck? Faultless handling of an emergency? Let's analyze a bit, but first let's say that successful as this entire operation was, disaster lurked only a breath away.

Monday morning quarterbacking is a pretty safe business. While nitpicking the performance of another we do not have to demonstrate how we would have acted. The following discussion of discrepancies and recommended actions is not for the purpose of criticizing the pilot but to help others who may find themselves in similar situations in the future.

This pilot had several things going for him and some of his actions contributed to his succesful ejection and landing.

- The aircraft was under control and he had lots of time to assess the situation and decide when to get out.
- He tightened his harness straps and lowered the visor.
- The zoom reduced airspeed to 135-140 kts and increased terrain clearance.
- He manipulated the shroud lines to control oscillation and control landing.
- The wingman and light plane pilot had him located.

There were several items however, that endangered the pilot and and hampered early rescue.

- When the emergency occurred he did not go to Guard channel (never did).
- He did not jettison external fuel tanks.
- He did not attach the zero lanyard although he was over mountainous terrain above an overcast.
- He discarded his oxygen mask during descent.
- He was unable to operate the riser quick release.
- Although he had the SARAH working, he accidentally turned it off when he placed it in the snow. It was, of course, then useless.
- Search was initially conducted about 10 miles away. The controlling agency, the light plane (VHF equipped) and the search aircraft (UHF equipped) had difficulty communicating.
- The pilot lost the night flare and left a pen flare with his other equipment which he had abandoned on the hillside. The rescue helicopter had a hard time locating him in the darkness and, in fact, was on the last pass that fuel would allow when the crew spotted him.
- Radar was unable to pick up chaff in the ejection seat.

Some of the above may not be particularly significant, may not even have had any effect upon this emergency. Nevertheless AEROSPACE SAFETY thinks they bear mention because in another situation they might mean the difference between success and failure.

To begin with, this pilot should have gone to Guard channel. During the period of the emergency, up to ejection, the Center was working nine aircraft besides this flight of two. Despite the abuse of Guard, there was a reason for it being set aside for emergencies and it should be used for that. To digress a bit, with the new URT-21 locator beacon indiscriminate use of Guard channel will be even more serious. Again, we urge pilots and controllers to stay off Guard except in a bona fide emergency. Give the guy in trouble a chance.

The movie, "Passport to Safety," which depicts ejection, descent and landing techniques and which should be on every base, advises pilots to keep their masks and helmets for protection when landing in trees and against injury if they are dragged by the canopy. The pilot in this case kept his helmet but discarded his mask. He was dragged a fair distance but apparently was lucky in that he received no reported facial injuries.

The so-called quick release has been a sore point among aircrews and personal equipment people for a long time. A new one is in the mill and some of them may be on chutes by now.

Survival equipment experts have their problems. If they put a switch on an item they have to remember that it can be turned off as well as on. A person in a survival situation may not be thinking his best and could very easily push a button the wrong way. The new URT-21 locator beacon is activated when the chute opens and will broadcast continuously. It has a switch and can be turned off if the person determines this to be wise.

Someone goofed back down the road when the military went to UHF and everybody else, including the airlines, went to VHF. There are good reasons for the use of the two different systems but search aircraft should contain both systems for more effective communication.

Although he knew he needed a flare and put one in his pocket, this pilot left a pen flare with his survival gear. Then he lost the flare he had put in his pocket. The serious thing here was that he walked off and left his equipment—the stuff that could save his life—lying on that snowy hillside. Several questions arise: Could he have found his way back to the survival kit quickly in the dark? Might he have fallen over the nearby precipice in the dark while hunting for his kit? What if a storm had moved in?

This pilot deserves praise for the things he did right. He was also lucky. If Lady Luck is on your side, fine. But don't bet your life on her. ☆

STACKED DECK

Usually, when we run across a title like the one above we expect to read an account of how some unfortunate pilot faced an impossible situation, struggled desperately up until the last moment, then bought his piece of farmland. Stories on this theme have appeared in this and other safety magazines time and again.

This one is different. The twist of title came to mind following a round table discussion among weapon systems project officers and life sciences specialists here in the Directorate of Aerospace Safety.

One of the life sciences types kicked it off with a for-example-situation he has worked out for the T-Bird. First, he related, there is a point in the flight profile during which he is dead; dead, that is, if the flame thrower that propels his airplane suddenly conks out. This interval comes between liftoff, at about 120 knots, and the time the gear is in the wells, the flaps have been sucked up and airspeed has increased to 140-145 knots. The "dead spot" lasts five to six seconds. There's not much he figures he can do. If power failure occurs at this time he's going to end up in the cabbages or whatever else might happen to be growing off the far end of the runway. He's also decided that should he lose his engine at this stage he will stay with the bird. He will probably be dead, he figures, but if he punches out he knows he'll be dead. As a member of the life sciences group, he has been well indoctrinated with the futility of low altitude, low speed ejection attempts.

An ex-transport pilot recalled how, when flying fully grossed, especially out of an island base at night, the last thing he mentally prepared himself for on the line-up check was how he would push rudder, raise a wing slightly, and clean up the airplane if an outboard quit at or just after liftoff. He had his mind conditioned so as to expect the worst that could probably happen to him at a most critical control regime. He prepared himself against surprise and to react instantly in a way that would enable him to handle the emergency.

Another pilot explained that his pet procedure along these lines was to plan every approach as a missed approach. In his mind he was planning to execute the maneuver as shown on the letdown plate, arrive at published minimums, follow Dash One missed approach procedures and continue on out on the missed approach procedure. With this conditioning he had no trouble bringing terrain into his cross check, taking over visually and landing if he broke out above minimums. Flying VFR from a good approach to touchdown is duck soup. Being mentally set for a landing, then unexpectedly having to improvise a missed approach 200 feet above the ground is one of the most critical flight situations he felt he could encounter—he wasn't going to be surprised into it.

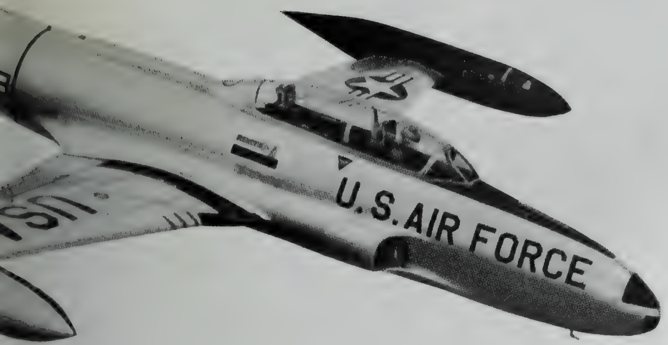
Another member of this informal seminar chimed in at this point to tell of reading how an overseas airline has had a practice of having the first officer make the approach any time the weather is reported at or near minimums. The only thing the first officer knows how to do in this situation, so he recalled, is to fly the charted approach to minimums and execute the missed approach. As of his latest information, he reported that this airline has never had a landing accident in near-minimum weather conditions during hundreds of approaches under such circumstances. He reported that a captain of the airline said that on more than one occasion, before he could fully decide whether or not weather conditions were good enough for him to take over and land, the first officer had solved his moment of indecision by starting the go around.

Later, but on the same subject, a test pilot who had flown spin tests in the T-37 endorsed this theory. Never, he said, had he failed to bring the little trainer out of a spin when he followed the mechanical, Dash One, 5-step procedure. However, he emphasized he had drilled himself by practice and mental discipline to follow the procedure exactly—even though the Tweetie might be trying to paste him against the side of the canopy at the time.

A century series jock chimed in with the inescapable truth that, should the engine unwind between break and flare, there's only one choice, and that an immediate one—punch out!

There were other examples, but, in summary, the consensus was that any pilot could apply these same techniques to better prepare himself for critical flight conditions. All he has to do is to analyze *what are the worst things that can happen to me in this airplane?* Once he has done this (and here's an excellent place to do a little research and learn from the mistakes of others) he can devise his own mental "set" that will enable him to be best prepared should he suddenly, someday, face a critical situation. He can then do a bit of defensive driving, and do it when it counts most.

As past accidents have proven, you can wait—figuring that a dire emergency is highly improbable, and if one does occur it will probably be to the "other guy"—and face a stacked deck that you just won't quite be able to beat; or you can do a bit of planning on your own and stack the deck in your favor. ☆



FUEL SYSTEM ICING *in the T-33*

There are many misconceptions concerning icing of the T-33 fuel system. This article clarifies some of the apparent misunderstanding by passing on information obtained from test programs, engineering studies and other sources.

Edgar M. Gibbons, Sacramento Air Materiel Area

There are two types of fuel system icing in the T-33 that will cause a flameout. They are *external* (around and in the aneroid) and *internal* (in the filters or the main fuel control). External icing requires the least discussion so we will dispose of it first. The main fuel control aneroid protrudes into the airstream and is subjected to a coating of ice on practically every flight. This has been borne out by inflight pictures taken near Perrin AFB during a service test. These pictures show ice building up on the accessories and accessory case even when the aircraft was flying through clear air. When ice completely seals the aneroid or when moisture freezes between the wafers of the aneroid it will cause an erroneous high altitude indication. This in turn causes the fuel mixture to be leaned out to the point where it will not burn and the fire goes out. It's as simple as that.

All T-Birds have a sheet metal shield installed around the front half of the aneroid that prevents the ice from doing any damage except for those rare cases when you can see ice building up on the airframe. When this happens, such as during penetration of a thunder storm or cloud formations, the ice buildup in the plenum chamber is both heavy and rapid and a flameout can occur either at that time or from 15 to 30 minutes later when you are out in the clear and think you are home free. The solution? Whenever you encounter airframe icing do two things: first, execute that maneuver known as "getting the hell out of there," and then get ready to switch to the emergency fuel control at the first indication of a change in fuel pressure, EGT or RPM. If you flameout, hit the Gangstart switch. In either event you may end up operating on the emergency fuel control which is not subject to external icing and is almost totally immune to internal icing.

Assuming that the fuel used is not treated with the anti-icing additive, internal fuel system icing is a complex phenomenon requiring a number of variables to be present simultaneously and within rather narrow limits, in order to produce serious icing. These variables consist partially of such things as: the amount of free water in the system, principally the fuel tanks; the amount of water dissolved in the fuel, this in turn is determined by temperature and to some extent humidity; the rapidity of the lowering of the fuel temperature and the final temperature reached, which is partially a function of the duration of the flight and the outside air temperature, etc. Examination of these variables will provide answers for some of the questions about why and when icing occurs and will also upset some common misconceptions, such as, "JP-4 has an affinity for water" (compared with what?).

Free water in the fuel system comes primarily from three sources: improperly maintained fuel storage and handling equipment, rejection of dissolved water by the fuel and condensation in the fuel tanks. Good maintenance and quality control in fuel handling and servicing equipment and procedures will eliminate servicing as a water source. The dissolved water in the fuel obviously cannot be prevented from entering the fuel tanks. However, this dissolved water presents no serious problem. JP-4 does not have any natural affinity for water. However, it does contain an extremely small amount of dissolved water at all times. This water is measured in parts per million (PPM) and the amount of water that can be absorbed by the fuel is a direct function of fuel temperature.

When fuel temperature decreases water is rejected by the fuel in the form of small drops or particles which will eventually settle to the bottom of the tank if the fuel is not agitated. Assuming a full fuel load of 813 gallons at a starting temperature of 70°F (21°C) and cooled to a final temperature of -10°F (-23°C), the fuel would reject about 50 PPM by volume, or about four fluid ounces. In actual practice the amount of water would be less than half this amount since you normally would burn over half of the fuel before fuel temperature could be reduced to -10°F. The rapidity with which the fuel cools determines the size of the water particles rejected from the fuel. A fast cool-down period of one to two hours will produce particles from four to ten microns in diameter. A slow cool-down will produce particles of 15 to 40 microns in diameter. The small particles due to their size tend to pack more tightly and also tend to clog filters and screens more rapidly. The critical fuel temperature range at which icing is most probable and most severe is from +10° to -20°F (-12 to -29°C).

Water condensation in the fuel tanks is negligible during any one flight. The tiptanks are frequently suspected of producing excessive amounts of water, particularly after they are empty and an air flow can take place. This contention, however, is not borne out by the facts. A study made several years ago by one of our aeronautical engineers showed that only minute quantities of water (on the order of a tablespoonful) could be produced if the best possible conditions for condensation were present during a maximum duration flight. This low water yield for warm moist air is further substantiated by tests made by SBAMA in 1961 which showed that empty tanks filled with 18,236 gallons of sea level air at 90°F and 100 per cent humidity produced only six-tenths of a gallon of water.

In any event, if the fuel system is drained after each flight and before refueling, most of the water in the fuel system will be removed. Since the T-33 has no clearly defined sumps it is necessary to drain the water before refueling to prevent the turbulent action of the fuel from dispersing the collected water.

All of the preceding comments on icing problems presupposed that fuel treated with an anti-icing inhibitor was not used. When the anti-icing additive is used the water in the fuel and fuel system does not freeze. This is not meant to imply that normal maintenance, such as draining, is not required, because it very definitely is necessary. Contamination of the fuel system by corrosion by-products or other foreign matter has caused a majority of the flameouts that are charged to icing.

The two major sources of fuel system contamination are the fuel servicing equipment and the fuel de-icing alcohol system. Fuel servicing can be eliminated as a contamination source by merely adhering to existing directives on maintenance and operation of fuel storage and dispensing equipment. The fuel de-icing alcohol system is a horse of another color. The only sure way to eliminate this system as a contamination source is to remove it from the aircraft. This we are trying to do with T.O. 1T-33A-622 "Deactivation of the Fuel De-Icing System." However, some aircraft are still using the fuel de-icing system even though additive treated fuel is usually available. This continued use of alcohol is predicated on the premise that these aircraft will occasionally be serviced with gasoline or untreated JP-4 type fuel.

Actually the continued use of the de-icing alcohol system is much more apt to cause a flameout from fuel system contamination than from icing if the aircraft is serviced with untreated fuel.

The contamination that builds up in the de-icing alcohol system consists of a jellylike substance that spectrographic analysis shows to be about 90 per cent aluminum hydroxide. This substance is produced by electrolytic corrosion from the bi-metallic couples in the alcohol system and by the corrosive action on the aluminum tanks, lines, etc., by the water saturated alcohol. Alcohol itself is essentially non-corrosive. However alcohol, unlike JP-4, will accept and readily combine with almost unlimited amounts of water, and it is this mixture of water and alcohol that does the dirty work.

The aluminum hydroxide gel can not be drained from the system but continues to build up until it breaks loose when the alcohol pump is used. It is then injected into the fuel system at a low pressure fuel filter which readily passes the material to proceed down stream, where it can lodge in the fuel controls and the air adapter finger screens. It is at these points that contamination can disrupt the proper functioning of the engine fuel system and can cause a flameout or erratic engine operation. These malfunctions are usually attributed to icing, so the pilot uses alcohol to melt the non-existent ice. This could aggravate the situation by adding more contamination.

Fortunately, the emergency fuel control will usually continue to function in the presence of severe contamination; it might be erratic but it works enough to get you home. It is interesting to note that the fuel controls that have been used without alcohol and with fuel containing anti-icing additive show no evidence of corrosion when returned to overhaul. This is in direct contrast to the badly corroded appearance of fuel controls when alcohol has been used.

This article could continue indefinitely exploring all of the ramifications of the fuel system icing and contamination problems. However, to do so would only bore the readers by dwelling endlessly on rather irrelevant matters. So in conclusion here is some friendly advice. When fuel treated with anti-icing additive is generally used in your T-Bird, get rid of the alcohol system. And when you can see ice building up on the airframe be ready to switch to the emergency fuel control. You do these two things and ice will cease to be a problem. ☆

AIRCRAFT ICING

. . . a new look

Lloyd V. Mitchell, Hq Air Weather Service, Scott AFB, Ill

Generally speaking, airframe icing is not considered a problem for most of our high-performance jet aircraft because they are designed to operate above the icing levels. This is great! But, as they climb out or let down, these aircraft must frequently pass through conditions which are conducive to icing. Also, it is not always that these high-performance aircraft operate above the icing zone. For example, a few years ago a group of jet bombers was operating at low altitude in icing conditions. Not only did ice accumulate on the wing leading edges, it also built up on the engine nacelles, then flaked off causing considerable damage to the engines as it was ingested. One aircraft didn't make it to the runway, and others had considerable engine damage.

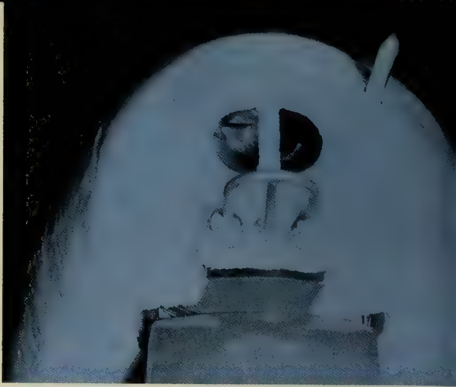
More recently, another jet bomber picked up a tremendous load of ice. This aircraft was mushing along in a nose-high attitude and the ice accumulated on the under side of the wing. Although this caused a considerable loss of altitude, recovery was effected before an accident occurred.

Just what are the basic conditions for airframe icing? There are two: the aircraft-surface temperature must be colder than 0°C, and liquid-water droplets at subfreezing temperatures must be present in clouds. Aeronautical engineers and meteorologists have no control over the latter condition but the engineers have done fairly well in taking care of the aircraft surfaces. In the newer aircraft, the wings are heated either by hot air or electrical current to prevent the accumulation of ice. Also, aerodynamic heating due to the speed of the vehicle may be sufficient to prevent icing. In the older aircraft, and we do still have some of them around, mechanical boots are used on the leading edges of the wings and stabilizers, and anti-icing fluids are used on the rotating surfaces such as propellers and helicopter rotor blades.

Rime, clear, or a combination of rime and clear are the types of icing which aircraft may experience in flight. Rime ice is a rough, milky, opaque ice formed by the instantaneous freezing of small supercooled droplets as they strike the aircraft. Rime occurs predominantly in stratus-type clouds. Clear ice is a glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled droplets. In contrast, clear ice is more predominant in cumulus-type clouds.

Icing occurs in various intensities, but until recently, there was no uniform set of definitions of icing intensities. Now, representatives of the Air Force, Navy, Army, Coast Guard, Weather Bureau, FAA, and NASA have agreed upon a set of intensity definitions. Light, moderate, severe, and extreme, which were used by the Air Force,

In this article a veteran Air Weather Service meteorologist gives the new definitions of icing.



have been superseded by trace, light, moderate, and heavy.

Liquid-water content of clouds and icing rates are used to determine the intensities. The icing-rate criteria are based upon the rate at which ice accumulates on a small probe. Since our aircraft do not have such a probe as part of their standard equipment, we have included some features which the aircrew will be able to recognize. The operational definitions are listed in the box on this page.

The occurrence and intensity of airframe icing depend upon many meteorological and aerodynamic factors. Temperature has a direct effect on the portion of water which freezes. Liquid-water content in the cloud is probably the most important in determining the ice-accumulation rate. The higher the liquid-water content, the greater the ice accumulation. The maximum liquid-water concentration usually occurs at a lower level in stratiform clouds than in cumuliform clouds. Within the cloud, the liquid-water content increases with altitude to a maximum value and then decreases. Droplet size also affects the icing rate. The larger the droplet size, the faster ice will accumulate. Usually, the droplet size is larger in cumuliform clouds than in stratiform clouds.

The icing rate depends to a large extent upon the collection efficiency, i.e., the fraction of the liquid water collected, of the aircraft component involved. The collection efficiency varies directly with droplet size and aircraft speed and inversely with the component size. For example, the antenna mast is a more efficient collector than the leading edge of a thick wing. Aerodynamic heating, the temperature rise resulting from compression and friction as the aircraft penetrates the air, lessens the icing hazard on high-performance aircraft at high speeds. For example, the amount of heating for an aircraft flying at 150 knots at 6000 feet is a little more than 1°C but at Mach 1.0 at 6000 feet the heating is 36°C. The amount of heating decreases with altitude. For instance, at Mach 1.0 at 30,000 feet, the aerodynamic heating is only 26°C.

The design characteristics of aircraft have a decided effect upon the occurrence and accumulation rate of icing. Therefore, since there is a great variety of aircraft models in the USAF inventory, our icing problems today are quite varied. The oldtimers are well acquainted with the icing encountered by reciprocating-engine aircraft. Ice accumulates on the wings, canopies, air scoops, propellers, and other surfaces. Also, carburetor icing may occur with free-air temperatures well above freezing when fuel is mixed with air having the proper temperature-moisture conditions.

Turbojet aircraft are usually operating above the levels where icing exists. However, these high-speed aircraft are apt to encounter airframe icing during climb, let down, approach, go-around, and low-level operation in icing conditions. Remember the instances cited earlier in this article? Jet fighters, due to design characteristics and greater speed producing more aerodynamic heating, are less susceptible to icing than are jet bombers and transports. For the same reasons, jet bombers are less susceptible than prop-driven transports.

Engine icing also occurs on and in jet engines. USAF Technical Order 1-1-469, "Operation of Aircraft with Jet Engines Under Icing Conditions — All Jet Aircraft," 25 August 1955, gives an excellent discussion on the icing of the components of a turbojet engine. Jet pilots would do well to read this T.O. periodically.

Rotary-wing aircraft are quite susceptible to icing and, therefore, are not usually operated in icing conditions. The Canadian National

Trace of Ice: Accumulation of one-half inch of ice per 80 miles on a small probe. The presence of ice on the airframe is perceptible but the rate of accretion is nearly balanced by the state of sublimation. Therefore, this is not a hazard unless encountered for an extended period of time. The use of de-icing equipment is unnecessary.

Light Icing: Accumulation of one-half inch of ice per 40 miles on a small probe. The rate of accretion is sufficient to create a hazard if flight is prolonged in these conditions but is insufficient to make immediate diversionary action necessary. The occasional use of de-icing equipment may be necessary.

Moderate Icing: Accumulation of one-half inch of ice per 20 miles on a small probe. On the airframe, the rate of accretion is excessive, making even short encounters under these conditions hazardous. Immediate diversion is necessary or use of de-icing equipment is mandatory.

Heavy Icing: Accumulation of one-half inch of ice per 10 miles or less on a small probe. Under these conditions, de-icing equipment fails to reduce or control the hazard.

Aeronautical Establishment conducted tests which showed that ice accretion of about 3/16 inch on the main rotor blades was more than enough to prevent a helicopter from maintaining height during hovering flight. Other rotor blades, control rods, and air intakes are also susceptible to icing.

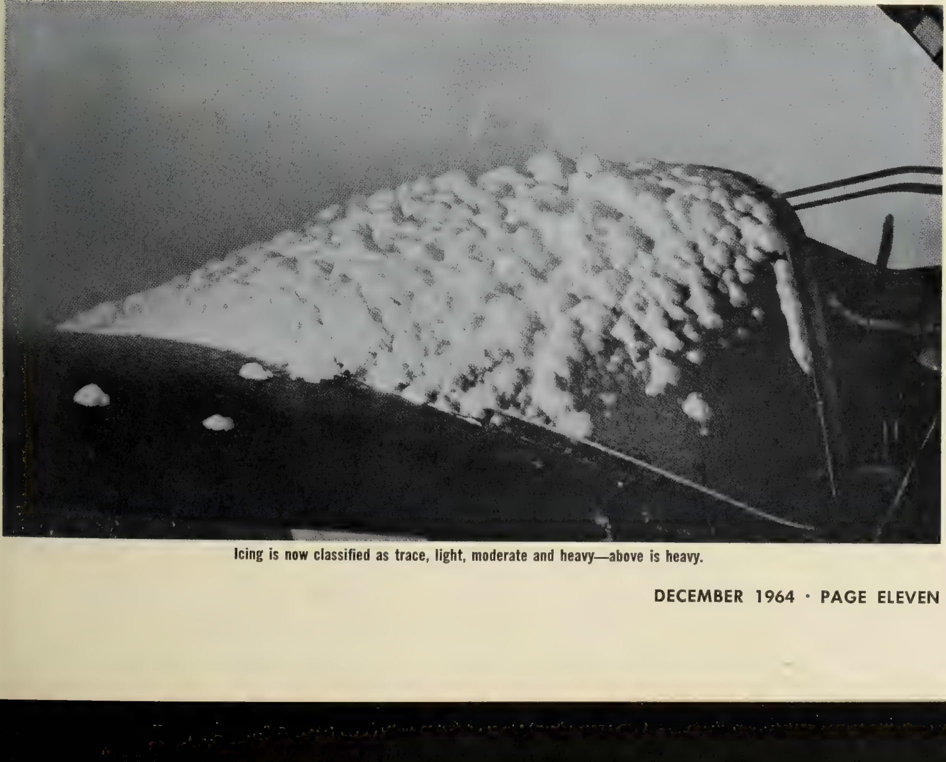
As stated earlier, a basic condition required for aircraft icing is the presence of supercooled water droplets, i.e., clouds composed of liquid-water droplets which are colder than 0°C. Since liquid-water droplets are rare at temperatures colder than –40°C, aircraft icing is almost unheard of at these cold temperatures. Generally, the frequency of icing decreases rapidly with decreasing temperature and icing seldom occurs at temperatures colder than –30°C. Therefore, icing is usually restricted to 30,000 feet and below. Rime ice predominates at colder temperatures, whereas clear ice is more common at temperatures just below freezing.

Rime and mixed icing are more common in low and middle level stratiform clouds and the intensity ranges from a trace to light. The icing layer averages from 3000 to 4000 feet in thickness. On the other hand, icing in cumuliform clouds has greater vertical extent. It is usually clear and the intensity ranges from a trace in small cumulus to light to moderate in the larger cumulus clouds. The most severe icing, and it can be heavy, occurs in cumulus congestus clouds just prior to their change to cumulonimbus. In other words, icing is more severe in cumulus clouds which are building and less severe in those which are dissipating. Also, icing is generally restricted to a shallow layer near the freezing level in a dissipating thunderstorm.

Icing is more intense over high, steep, mountainous terrain than it is over low, flat terrain under apparently identical conditions. Moderate icing, usually clear, occurs in the convective clouds over mountainous terrain and is usually greater over ridges than over valleys. The windward side of mountains, particularly along coastlines in winter, are especially subject to extensive aircraft-icing zones.

Winter is the season of maximum aircraft icing! Half of the 114 aircraft accidents occurring from 1946 through 1958 in which icing was a factor occurred in the three winter months. So, you can see the timeliness of this article. Don't let this winter claim you as an icing statistic.

Also, remember that icing intensities have a new look this year. A trace of icing means just that — it is perceptible but the rate of accretion is almost balanced by sublimation; it is not considered a hazard. Light icing can be a hazard if flight is prolonged in the icing zone; however, immediate diversionary action is not necessary but occasional use of de-icing equipment may be required. Moderate icing is a hazard even during short encounters; immediate diversion is necessary or use of de-icing equipment is mandatory. Heavy icing is the uncontrollable situation; de-icing equipment fails to reduce or control the hazard. ☆



Icing is now classified as trace, light, moderate and heavy—above is heavy.

FIRST AID . . .
’til the medics arrive

Willie Hammer, Directorate of Aerospace Safety

Since accidents happen and people may be injured, every airman should know what to do until medical assistance arrives. The first aid measures indicated here should be taken prior to the arrival of medical personnel. This will generally be only a matter of minutes if the injury occurs at an Air Force installation. These measures are of extreme importance since the actions taken during the first few minutes may determine the severity of the injury. Most of this material is taken from AFP 35-5-3, “First Aid for Airmen,” which should be studied and consulted when more detailed information is desired.

Injuries requiring prompt action may result from one or more of the following:

- Asphyxiation or inhalation of toxic gases or liquids.
- Electrical shock.
- Corrosive burns.
- Wounds and cuts.
- Thermal burns.
- Bone fractures.

In case of an accident in which serious injury has occurred:

a. Move the injured person as little as possible. However, in cases of:

ELECTRICAL SHOCK – move him from the conductor with which he is in contact, using wooden poles or other nonconducting devices if the current cannot be shut off.

ASPHYXIATION or exposure to toxic gas – move him to fresh air, or supply him with oxygen.

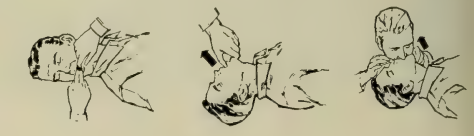
ACID BURN, corrosive and cryogenic splashes – put him under an emergency shower, remove any clothing saturated with the harmful liquid, and wash off the liquid with large amounts of water.

FIRE or imminent danger from collapsing structures or possible explosion – move him to a safe area.

NOTE: USE CARE THAT YOU DO NOT BECOME A CASUALTY YOURSELF. KEEP CALM, BUT TAKE PROMPT ACTION.

b. Check for breathing and bleeding.

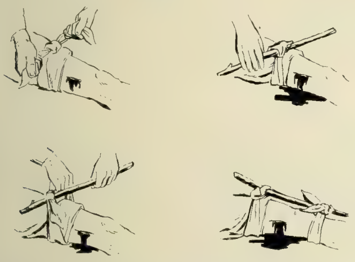
ARTIFICIAL RESPIRATION. Give artificial respiration to persons whose breathing has stopped. If a pulmotor is not available, start mouth-to-mouth resuscitation immediately. Keep it up until breathing has restarted or until medical personnel take over. (Figure 1). Oxygen may be given after a person is breathing in order to reduce shock. Remember that only an in-



halator which will induce lung action is an adequate subsititute for artificial respiration. Ordinary respiratory protective equipment is not adequate.

BLEEDING. Stop any uncontrolled bleeding by use of a compress. Do not touch the wound or permit it to become dirty in any way. The compress may be a dressing from a first aid kit, a clean handkerchief, towel or shirt. Apply it to the wound with firm pressure.

Use a tourniquet *only* if compress pressure does not work. *Do not use it otherwise.* The tourniquet should be placed between the wound and the heart and tightened only enough to stop gushing of the blood from the wound. Keep the tourniquet tight until medical assistance arrives. (Figure 2).



ASSISTANCE. Send for medical assistance as soon as possible. Emergency measures mentioned should not be neglected in order to summon medical personnel. Send someone else if you can. After medical personnel arrive, let them take over, but provide such assistance as they request.

SHOCK. Try to prevent or to treat shock. Keep the patient quiet and warm. Make him comfortable by loosening his clothes and removing any bulky or heavy items. Protect him from chill with a coat, blanket or other covering. Move him as little as possible, and with due regard for any possibility that he might have a broken bone. If there is no head wound or broken leg, lower his head and shoulders and raise his legs. This will help increase blood flow to the brain. If there is a head wound, keep the patient lying flat with his head either raised or at least level with his body.

UNCONSCIOUSNESS. If the injured person is unconscious, but breathing, place him face down with his head turned to one side to prevent choking from vomit. Be very careful not to obstruct airways by cramping his neck. Once in a position, do not move him again. Do not try to give him a drink if he is unconscious.

FRACTURES. A person with a fracture must be handled carefully to prevent making the injury worse and increasing the shock. In an emergency, there will probably be no time to check broken bones before the injured person is moved. After he is in a safe location, move him as little as possible. A fracture may be suspected if:

- There is an inability to move a part.
- The part has an abnormal shape.
- There is pain on movement with extreme tenderness over the injury.
- Swelling and change in color of the skin.

BURNS. Burns may be due to high temperatures or cryogenic temperatures. First aid measures are the same for both. Treat the patient for shock and obtain medical assistance. Do not touch the burn or try to remove pieces of fabric which stick to the burned area. The patient may be given plenty of non alcoholic liquids provided there is no evidence of internal injuries. Cases in which injuries are minor and not emergencies may be treated at more convenient times. However, *all* injuries, no matter how minor, should receive medical attention.

INTERNAL INJURIES. In the event there appears to be internal injuries, do not give any fluids by mouth. Treat for shock and move as little as possible. Intravenous fluids should be given only by medical personnel.

All personnel should be familiar with the location of first-aid kits and emergency equipment, their contents and how to use them. Safety officers should request that medical personnel instruct airmen and officers in the use of this material and emergency first aid, providing demonstrations where advisable. All personnel should be required to practice these procedures to assure they have acquired and retain adequate knowledge and skill in these areas. ☆

Besides AFP 35-5-3 and instructions and demonstrations by medical personnel, training aids and films are available which will provide additional information. Some of these are:

AFM 160-35, Medical Airman's Manual.
FTA 458, Techniques of Air Exhaled Artificial Respiration.
TF 1-8164, First Aid, Part 2, Every Day Emergencies.
TF 1-8172, First Aid For Air Crews.
TF 1-8185, First Aid For Fractures, Introduction.
TF 1-8189, Control of Hemorrhage.

Survival experts say the first few minutes are the most critical in a survival situation! Your chances are excellent if you . . . .

PANIC NOT!

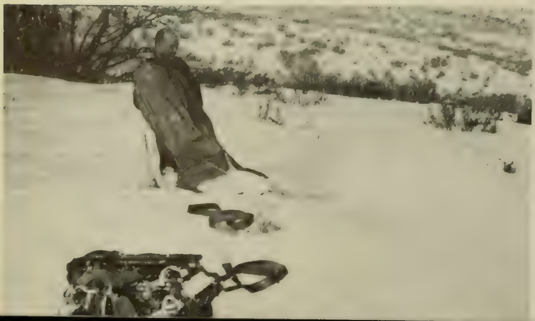
Get on the canopy release — quick.

One cold day last winter a Hill AFB photographer, pararescuemen MSgt Howard Gould and SSgt Bernard Casey, and the author plowed through waist deep snow with the idea of staging a series of pictures to illustrate what the two rescue experts feel is one of, if not the most, important aspects of survival—*not panicking.*

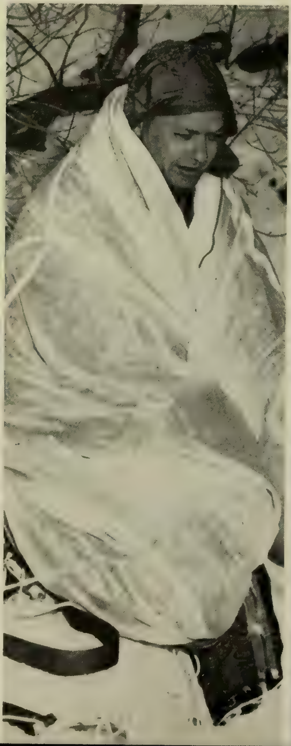
First, we wanted to get the point across that after landing one must get his parachute canopy collapsed. Bernie Casey agreed to be the subject. He was outfitted with the gear a T-33 pilot would probably be wearing and have with him for survival. Bernie got

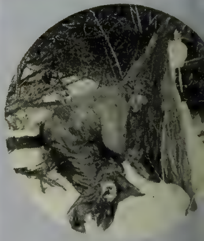
Guess I'm in one piece. Now what?

Better gather up the chute, I'll need it.



This cuts the wind, now to think things over.





First, I'd better get a shelter built.

Now, what's in this survival kit?

on his face in the snow and we released the chute. The breeze quickly blossomed the canopy and our survivor started plowing up the snow with his face. He managed to turn himself onto his back where he could get to the canopy release. The chute quickly collapsed. So far, so good. But did you ever try to get to your feet in about three feet of powdery snow? It wasn't easy, but Bernie finally made it. Actually this was kind of a bonus, because we hadn't foreseen how difficult it was going to be for him to get on his feet. He was puffing pretty hard and had worked up a sweat. It was at this point that he and Sergeant Gould agreed that a lonesome survivor could wear himself out floundering around in snow, and, being already in an apprehensive state of mind, might panic. Bernie retrieved his chute and wrapped up in the canopy to get out of the wind while he took a few minutes to calm down, think through his problem and decide what to do next.

Since there was plenty of firewood available at this spot, Bernie decided the first thing to do was erect a shelter. He used the parachute canopy for this, making sure the cloth was securely fastened to a low tree with suspension line. Then he gathered firewood and got a fire going.

Now he was pretty comfortable and he could really get into the problem of surviving until help appeared. The one thing he kept constantly at his side was his survival pack — he was taking no chances on losing it in the snow. After inventorying the contents, he perused the survival manual. This served two purposes: first, there's a lot of information in the book; second, the person caught in a survival situation, where his life depends on every act he takes, is not likely to be as calm as he would be in his own living room. Reading the book gives him time to simmer down while he's refreshing his memory on the many things he learned in survival school but may have since forgotten.

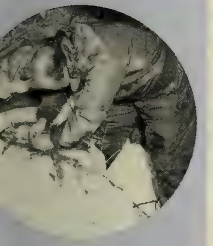
(When these pictures were taken the URT-21 locator beacon was not available. Nowadays this little goodie would be beeping away to give rescuers a fix).

The radio (URC-11) was the next thing our survivor used. Although we don't show it here, a good idea would be to put the batteries under one's clothing to keep them warm.

Finally help arrives. Aircraft engines can be heard in the distance and this is a good time to get a flare ready to use, and don't forget to keep the mirror handy. Now that the chopper is in sight the smoke flare does the job.

As we said earlier, this is not intended to cover the problem of survival thoroughly, but it is designed to emphasize actions that, had they been taken in at least a half-a-dozen cases we know of, those men would still be alive today.

As a suggestion, why not clip this section out and carry it with you when you fly. ☆

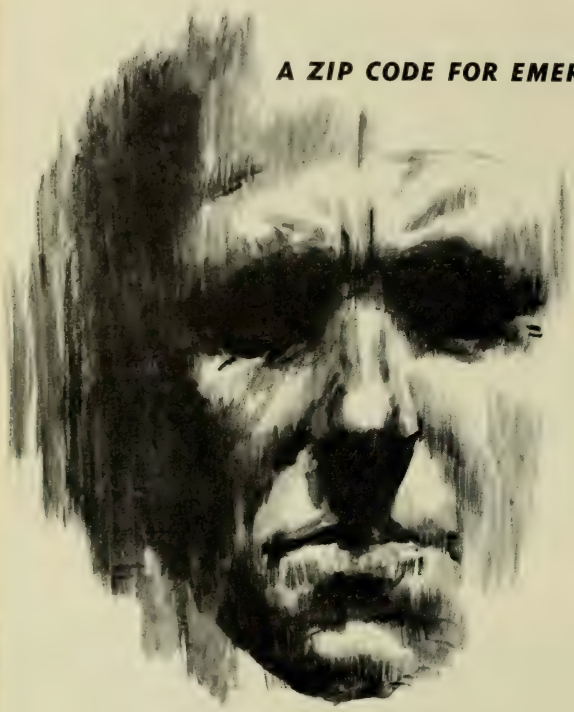


Lots of wood, I'll get a fire going.

This radio now. Fellas, I'm over here.

No rush, better see what the book says.

This ought to attract their attention.



A ZIP CODE FOR EMERGENCIES

Let's face it! The only reason that many of you are still alive is that you have never been faced with a critical emergency. Many of you have just been lucky; but how long will your luck hold out? Mine ran out when I forgot one step in an emergency procedure just like many of my friends. I forgot to change the fuel selector in my B-66 during a low altitude airstart. After I bought the farm, I had a chat with many other drivers down here and we figured out how we could survive if we had the chance again. We won't get it, of course, but you might. So take five and stay alive. Read on, MacDuff!

We figure that a critical emergency is one that requires immediate and instinctive reaction. Bold print procedures are not always critical. If your T-Bird flames out at ten thousand feet, you still have time to think a little and try a few airstarts before you leave it; but what will you do if it flames out at 300 feet after takeoff? That's what we call a critical emergency.

Loss of afterburner in the F-100 during nosewheel liftoff, opening of the T-Machine nose compartment doors during takeoff or a double flameout in an F-4C on final approach are other examples of what we would call really critical emergencies.

When you abort an F-105 at takeoff speed, there is no time to think it over; your reactions must be automatic. They will never become automatic by simply memorizing the bold print emergency procedures in the Dash One. A desk jockey down here can recite verbatim every procedure in his checklist but he bought the farm because it took him too long to spout out the steps and do them at the same time. See for yourself. Sit in a simulator or de-armed aircraft (seats and switches) and imagine that you have just lost your engine, or all of your engines, just after takeoff. At a given signal see how long it takes to accomplish your airborne abort procedure. Remember that this is not an academic situation, like the time when you took your annual written proficiency examination. You cannot mull over the next step. My buddy, Jim, used to place his students in a de-armed cockpit and time them through this procedure. Invariably they would start with their hands on their laps.

"You will be 300 feet above the ground at this time. Are you going to be flying this thing with your feet?" After the student grabbed the stick, he realized that every step would have to be accomplished with his left hand because he would be maneuvering for a landing with his right.

"The next thing they would do," explained Jim, "is look at each switch as they moved it. Scott Crossfield recommends it but not at 300 feet when you are about to crash land the bird in the nearest patch."

So now they realized that in addition to having the right hand on the stick, they had to be looking out the windshield. (See why blindfold cockpit checks make sense?) Next they would perform a few steps quickly and then stop to think about the following step. By the time they finished, it usually took 13 to 15 seconds—too long when the pressure is on and the ground is racing up to meet you.

After a few practice sessions, they could whip through it in five seconds flat but they stopped reciting each item. They just let their hands run through the whole procedure like a piano player who has learned a new piece. Now all they needed was a little practice to polish their performance and make it indelible in their minds. The only thing that was wrong was the learning process. It could have been accomplished quicker and easier by using a ZIP CODE. Here's how.

First, sit down with a cool one

in a quiet atmosphere and learn the critical items verbatim. Then get down to business. In each procedure, give every step a ZIP CODE, one word if possible but in no case more than two. For example, the first step in the B-66 Ground Abort Procedure is BOTH THROTTLES — IDLE IMMEDIATELY. Just write THROTTLES. The rest is really obvious and does not have to be written or recited. The second step is DRAG CHUTE — DEPLOY. Just write CHUTE. It's obvious that you wouldn't abort the B-66 without deploying the drag chute. Continue down the list in the same manner. You may finish with a procedure looking like this: THROTTLES CHUTE BRAKES THROTTLE BATTERY THROTTLE HATCHES GEAR FIRE.

After you have learned this ZIP CODE, go to the simulator or de-armed aircraft and practice until the whole procedure becomes an automatic reaction. Compare the times that it takes to say and perform all the steps using the full checklist and then using the CODE. You will find that without fail, your hands can beat the full checklist but you will never beat the CODE. If you don't believe me, try it. Remember the mind must act before the body in the learning process but once you have mastered the procedure, the hands act by themselves and the mind can move on to the next step —like abandoning the aircraft.

A few words of caution. Always give the same word to the same switch. Don't call them WING FLAPS one time and FLAPS the next. Think each item through carefully before you practice. If you abort on the runway in a T-Bird, you don't have to hold the stick and so both hands are free to act; for an airborne abort, only one hand is free. Be prepared for a mild shock. You will be surprised how soon the CODE will make your movements automatic. Check each switch to see which way it moves and how far. Practice the really critical procedures, the ones near the ground. Statistics prove that they are the biggest killers. There are many desk jockeys down here to prove it. ☆

THE GHOST PILOT

U& 8:20 month

Lt Col Richard R. DeLong, Directorate of Aerospace Safety

WHAT THE DEVIL DOES *this* MEAN? Well, it means there are a lot of pilots in this man's Air Force flying 100 hours a year in the so-called "proficiency flying program." This may include "U," and if so, the 100 hours breaks down to 8:20/month.

Now you can sit back and relax, because you know what it means But do you? I dare say, that half the pilots involved really *don't* know the value of the proficiency flying program other than the fact that it provides 8:20/month and 100/year.

Many pilots find a multitude of problems associated with maintaining currency and meeting annual flying requirements. The most outstanding is probably that of establishing a compatible timing arrangement betwen the people who manage the flying program and those to whom the individual is responsible in the function of his primary job assignment. The latter are his bosses (or boss), who control his time and day-to-day effort (and write his OER!). Most pilots wind up flying weekends (this irritates Mother), and/or, taking trips during the week, which requires homework (or overtime) to stay above board at the office.

Another serious problem is the uneven frequency of flights. This usually results in long periods of flying inactivity and many times necessitates a recheck in the airplane. Let's face it, after 45 days out of the cockpit, nobody is current, much less qualified!

The last, and perhaps most important, problem is that 100 to 110 hours a year just isn't enough flying time to keep a guy sharp. There is obviously no move afoot to increase the flying hours allotted for proficiency purposes. Although many will agree that more hours are required, the budget cannot afford us this additional time.

Okay, so now you say, "So what's new?" The obvious answer is, "Nothing." You are still stuck with all the problems and 8:20/month. However, there are some things you can do to help improve the situation. Here they are:

First: Make the most out of each flight. Re-study the emergency and normal procedures in the Dash-One and plan your flight well. Even if you have to go down to operations the night before, plan your flight well!

Second: Make the most of your time while flying. Practice normal and emergency procedures (even if you only go over them in your mind), practice instrument flying and make instrument approaches to every landing.

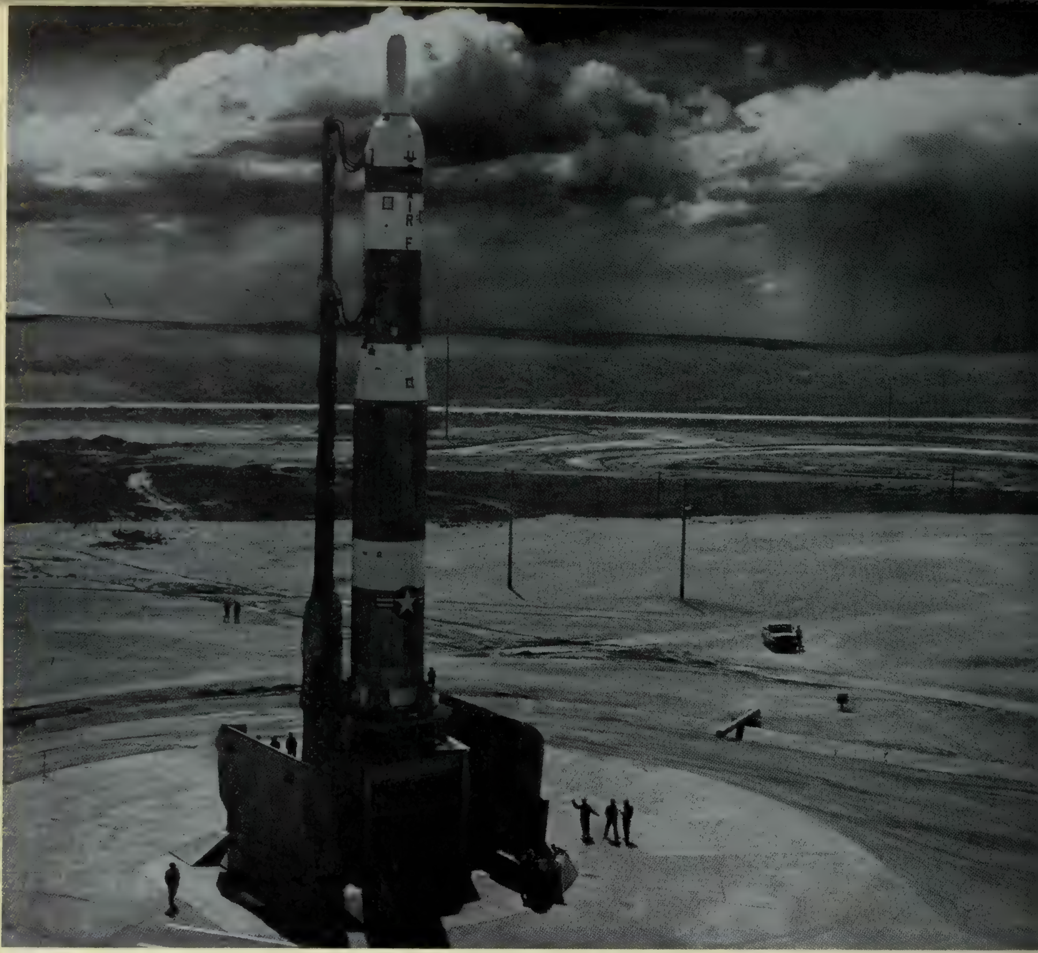
Third: Spend some time in the training section with the IP's. They're not a bad sort, really—they just fly for a living. Come to think of it, at 8:20/month, SO DO YOU!

Fourth: If you have trouble getting away from the office, talk the situation over with your boss. Ten to one he's an understanding troop who just didn't realize the problem.

Last: Study the Dash-One frequently. *FIND* TIME! Any one of us can be a stick-and-rudder expert, VFR in the local area. It's when an ornery airplane and the weather combine their efforts, that you usually get in a jam. When the palms are wet, the posterior is nervous and the adrenalin flows like prohibition beer, you might wish you had made the most of the program.

As Grandmother used to say, "If you don't feed the cows, you won't get a drop." Think about it.

P.S. Make sure your boss reads this!!! ☆



Emergencies at missile sites demand fast action. Teams of engineers and technicians are geared to move quickly when there's a

MISSILE MAYDAY

Col William J. Campbell, Chief, Titan SSM Div., SBAMA

As advanced weapon systems are developed and deployed, the need for quick logistics response becomes increasingly important, particularly where missile safety is involved. Consequently ballistic missile System Support Managers (SSMs), in coordination with the using command, found it necessary to develop realistic maintenance, supply, engineering, and transportation innovations to reduce support reaction time. However, in dealing with potential hazardous conditions which could develop at any one of a wide-spread network of bases, it became apparent that new concepts, involving precise lines of communication and teamwork, were required. While "Mayday — Mayday" is still used to identify extreme emergencies for missiles as well as for aircraft, the procedures for handling these emergencies differ considerably.

A plan which accomplishes these response objectives was initiated in support of the Titan, Atlas, and Minuteman weapon systems. The effectiveness of this planning and the high degree of intercommand coordination achieved has been repeatedly demonstrated during the past few months. A case in point concerns a potential hazardous condition which occurred at one of the HGM-25A (Titan I) bases.

On the morning of 2 July 1964, the phone rang in the home of Captain Donald Walker in San Bernardino, California. The time was 0330 hours; however, requests for engineering assistance were not uncommon this early in the day. Quickly, the problem was described and it was determined that immediate on-site technical assistance would be required at Ellsworth Air Force Base, South Dakota.

Before assembling the depot support team, only a few basic facts were known. After a fuel-only exercise with an operational re-entry vehicle installed, the SAC crew was unable to lower the launcher. Circuit breaker 19 in the launcher logic rack would "pop" each time an attempt was made to lower. Severe thunderstorms with high winds and cloud-to-ground lightning were in the area. One inch hail was forecast. It was imperative to lower the launcher and missile as soon as possible.

The team selected to accompany Captain Walker consisted of a SBAMA electronics project engineer and an American Machine and Foundry contractor's technical services representative. Departing Norton Air Force Base at 0545 by T-39 aircraft, the team arrived at Ellsworth Air Force Base at 0757. With the cooperation and support of the 44th Strategic Missile Wing and the 850th Strategic Missile Squadron, the difficulty was quickly pinpointed and corrected. Shortly after the launcher was lowered and the missile put in a "safe" condition, a severe thunderstorm, with heavy lightning and 40 to 60 knot winds, hit the missile complex. Had the technical support reaction been slower, the missile would have been exposed to the storm and may well have sustained major, perhaps catastrophic, damage.

To augment T.O. 00-25-107 support procedures for providing priority responsiveness to emergency requests, the SSM/AMA initially developed the Missile Engineer/Technician Teams (METTS) operations plan for the Titan and Atlas Weapon systems. These teams were equipped with the skills, equipment, and engineering data necessary to trouble shoot and correct those maintenance or operational difficulties beyond the combined capabilities of SAC and the appropriate geographical Air Materiel Area. Primary purpose was to provide immediate support in restoring missiles to EWO status and to correct serious safety deficiencies.

The hub of this operation is the SSM at San Bernardino Air Materiel Area who receives assistance requests from SAC or from the geographical AMA. It is his responsibility to determine the type of support to be provided and to obtain required Air Force or contractor engineering and technical assistance. During the first year of operation, this system of support proved extremely effective and prompted application to other advanced weapon systems.

Closely related to the METTs program is the Missile Potential Hazard Team concept SAC (Reg 355-3 and 4) which was developed by SAC in coordination with the missile SSMs. This regulation establishes responsibilities for directing those emergency measures and actions required to prevent or minimize damage and restore operational capability following peacetime missile potential hazardous situations. To cope with any safety problem, missile potential hazard teams are formed at Headquarters SAC, numbered Air Forces, 1st Strategic Aerospace Division, each SAC missile wing and squadron, and at the SSM/AMA.

Missile potential hazards include those situations arising during an operations or maintenance activity in which any portion of the system performs other than normal and technical data does not contain procedures for return to a safe status. Included, also, are those conditions which, although covered by technical data, could result in:

- Impending loss of life, serious injury, or entrapment of personnel.
- Impending collapse of missile silo doors, work platforms, or underground structures.
- Impending propellant dump or spills of propellants or gases.
- Impending missile explosion, silo fire, or propellant terminal fire.
- Impending damage due to wind or other weather factors.

The Missile Potential Hazard Team procedure establishes a firm communications network which permits conference tie-in with the Wing/Squadron, numbered Air Forces, SAC Headquarters, and the appropriate SSM/AMA. This "hot line" system is one of the keys to quick reaction. With AMA engineering and system technicians monitoring the call, the SSM can quickly determine the type of support to be provided and effect on-the-spot coordination with the various elements of SAC as to what system specialists or special skills are required. With SAC operational personnel available to describe the difficulty and SSM/AMA engineering and maintenance technicians also on conference call, it is frequently possible to arrive at a solution without dispatching crews, thereby solving the problem on the phone.

To augment the SSM/AMA team concept, contractor personnel are available on an open-call contract and are able to quickly respond to urgent requests for assistance. As a matter of fact, emergency support teams are frequently composed of both Air Force and contractor personnel.

With T-39 type aircraft standing by, it is possible to airlift personnel to any part of the ZI, accomplish the task, and be on the way back to the home base within a few hours. So whether the situation is LOX in the bottom of a silo, a stuck launcher, or simply inadequate technical data to cope with a safety problem, the SSM has the capability to react much more expeditiously than in the past. This, in conjunction with highly trained SAC personnel and precise inter-command coordination, will enable the Missile Squadron to recover from a potentially hazardous condition in a minimum of time. ☆

Doing what comes naturally

Anchard F. Zeller, Ph.D., Life Sciences Division

Doing what comes naturally may be fun, but not when it threatens to inadvertently separate a pilot from his faithful aircraft way up in that thin cold air. In the pilot's own words:

"There were two pilots on this X-country. I occupied the back seat on this leg. During letdown, we had to fly through tops of cumulus build-ups. In preparation for the bumps both of us tightened our safety belts. Passing through the first cloud involved sufficient turbulence to throw me upward and hit my helmet on the canopy. My hands weren't gainfully employed at the time, and in a reflex action they instinctively grabbed the seat armrests. I felt the right armrest start up, and simultaneously (also in a reflex action) tried to push it back down.

"Fortunately the armrest didn't come up far enough to fire the canopy initiator. I put the safetypins back in the two initiators, but the one for the armrest wouldn't go all the way down.

"Landing was made without incident. Maintenance returned the armrest to normal stowed position (involved rotation of the hand grip ring). Subsequent investigation confirmed that the ejection seat and canopy were correctly rigged and that the armrest had not been moved upward very far. BUT the image of what could have happened is enough to make me take positive action to prevent my hands from inadvertently grabbing the armrest handles in the future."

The human body is a fine piece of equipment with built-in features that would make an automation expert turn green with envy. How convenient it is that so much internal action is so automatic. Even such controlled activities as breathing go their life giving way without interruption when attention is diverted elsewhere. Some automatic actions, however, can produce trouble. Reflex actions were built into his system to protect man from the emergencies arising in his natural habitat. They can cause difficulties, however, in the artificial environments which he has created for himself. Responses which make man ready for physical combat make him less capable of dealing with the abstract decisions necessary for his survival in these new surroundings.

Some actions can be controlled by directive but these automatic responses do not come under that heading. Some can be managed by personal discipline and good intentions. Reflex responses are equally impervious to this approach; yet, they can be controlled. The key to their control is given many fancy names by the experts but they all come to one thing, job proficiency. Each individual must be aware of his limitations, aware of the demands of his job — and then practice, and then practice some more! Overlearning each step of the correct procedure until it becomes so automatic that it replaces the old is the key to survival. Emergency procedures particularly should be practiced to such an extent that any unanticipated event only sets off a series of corrective responses rather than producing undue emotionality. Once these things are learned, they must be repeatedly relearned. The pilot in this incident was no novice but very experienced both in aircraft driving and knowledge of human frailities. Yet, he forgot to keep his hands occupied in such a manner that inadvertent actions would not create an emergency rather than coping with one.

Don't think you know, KNOW you know, and remember — you are never too old to find that doing what comes naturally may be the wrong thing to do. ☆

FAA ADVISORIES

Bob Terneuzen, FAA Liaison Officer
Directorate of Aerospace Safety

FLIP Terminal (High Altitude) — It has recently come to mind that there is no way for controllers to determine what navigational equipment is left to a pilot who has experienced a communications failure. Yet, regardless of this, certain high altitude approach charts advise pilots that this or that plate is not to be used in the event of lost communications. In the majority of cases, a determination of this type was for the protection of departing or en route aircraft.

Reports submitted by Air Traffic Control facilities indicate that in a large number of cases it has been possible, through use of radar or emergency frequency, to control the aircraft to a landing. Consequently, through coordination with USAF and USN, it has been determined that all high altitude approach plates may be utilized in the event of two-way communications failure and the restrictive information removed from the plates.

ALLEGED VIOLATIONS — Have you ever received a "Notice of Investigation" from the FAA? Yes, I know, I didn't even have to mention this subject! However, pilots do receive these notices and I thought it might help if you understand the importance of prompt action on your part. The longer you delay, the greater you increase the chances of not finding the records and voice recordings of your flight, since the FAA normally retains these items only 30 days. Therefore, upon receipt of the letter, I would suggest you notify your commander (he may have already received a copy of this notice from the FAA) so that he may obtain the necessary facts concerning the incident. In many cases prompt action has revealed circumstances that have proven valuable in the defense of the pilot.

GCA vs. ASR — For safety's sake, understand the difference in radar approaches. The FLIP Terminal (high and low altitude) for instance, informs the pilot that radar is available at a certain base. It does not identify the type radar, i.e., Ground Controlled Approach (GCA) that furnishes elevation information as well as azimuth and distance (which we term "precision radar") or whether the base has only Airport Surveillance Radar (ASR) which provides azimuth and distance only. Of course, ASR approaches are not as precise as GCA, which means that course is not as accurate nor is elevation information available. (Recommended altitudes are provided.)

Steps have been taken to more adequately inform the pilot relative to the type radar he may expect for approach at an Air Force Base. The words "RADAR AVAILABLE" will very likely be replaced with "ASR" or "GCA AVAILABLE" on high and low altitude approach plates. In the meantime, remember that the specific radar service available at an airport is listed in the Enroute Supplement.

AIRCRAFT LANDING AID FOR PROBLEM AIRPORTS. A new component for ILS, called the Capture Effect Glide Slope (CEGS), has been developed by FAA to replace existing ILS glide slope systems at airports where terrain irregularities interfere with ILS performance. It provides the pilot with more reliable and precise guidance at problem sites, also more definite "fly up" indications at altitudes below the normal approach path.

CEGS will permit upgrading of ILS performance at specific airports leading to eventual capability of all-weather performance. Other benefits to be realized by its installation include use of these airports in minimum weather conditions which alleviates diversions, cancellations and delays. It is currently operational at Duluth and Knoxville Municipal airports (where USAF ANG units are assigned) and at Tempelhof Airport, Berlin. ☆

A little known activity in the Air Force is the ski mission being flown from Sondrestrom Field in Greenland. There are only six C-130D ski-equipped aircraft in the Air Force inventory, all assigned to the 17th Troop Carrier Squadron of the 516th Troop Carrier Wing at Dyess Air Force Base. Their basic mission is to provide resupply for personnel on the ice cap of Greenland. A second function is medical evacuation of seriously ill or injured personnel from any place in the northlands. Since practically all such missions are flown to sites which do not have landing strips, ski landings are a necessity.

When we got notice of our proposed trip to observe this mission and participate in ice cap operations, we also received a list of equipment that would be required. Arctic boots and liners, arctic mittens and liners, thermal underwear, parkas, sun goggles, iron pants, etc., were scrounged from the survival section along with arctic sleeping bags and blankets. Boy, were we prepared to rough it! Temperatures that week were sitting at about 25 below. Chill factors had to be considered — they were down around *three* just before we departed — so we got educated on the combination of low temperatures and high winds which bring on frostbite and frozen skin. *Five* is considered emergency and movements are held to a minimum.

Armed with this background, we departed a chilly Dyess (18°) for the northlands. Since we had a report of wind damage on a rudder, we detoured by way of the AMA to pick parts and stopped for the night at Loring (−12°). The next day we departed with our heavy clothes on and parkas ready. After about two hours of night flying (at 1530) we were treated to a brilliant display of northern lights.

Coming into the base, we encountered severe turbulence and gusty winds with airspeed fluctuations of 15-20 knots. We landed at midnight and stepped out — braced for our ordeal — into a 41° above temperature, chill factor zero! Some frontiersmen we were!

After checking into our nice warm Arctic Hotel accommodations and eating high on the hog at the fine mess the base provides, we sacked in. On our first mission to the resupply area the next day, the copilot reached up to pull the mike button for taxi directions only to have the control column fall back in his lap. While we were tearing up the floor, several of us thought back to the last flight up the fiord with all that turbulence and stick forces applied just before landing. Turned out that the magnesium casting connecting the stick to the elevator cables had broken in half. We got an Unsatisfactory Report off in a hurry.

Next mission went up on the cap to almost the 8000-foot level where resupply was to be accomplished and some ice cap qualifications transition was to be flown. Touchdown is similar to that for water landings. But those takeoffs! Hoo-boy!! Now I know why control columns fail. You accelerate to about 62 knots and yank (I mean pull hard, boy!) that stick back. If you're successful, the nose ski comes unglued. The best way of telling this is to check for an increase in airspeed. If you get it, then at around 72 knots you yank again and, according to the book, you become airborne. Of course, being somewhat below minimum control speed, if you lose an engine (outboard loss is especially interesting) you can plan on an immediate landing.

Runways (ha!) are no more than areas that occasionally have the snow drifts bulldozed to approximately level and portable lights generally aligned with the prevailing wind. They are no more than a designated four to five thousand foot area of the cap.

There are a few other problems involved in becoming airborne: in soft, deep or sticky snow, which we had due to the unseasonable temperatures, pulling hard doesn't necessarily unstick the nose ski. Under some configurations, 60 knots is almost unattainable. If the nose ski doesn't unglue, you don't go anywhere but off across the ice. To give you an idea, one of the old heads took some Army troops out onto the open cap a few weeks ago looking for some equipment they had put out for an experiment. He made a good open cap landing and while he was on the deck did some scouting for best takeoff direction. Some 30 minutes later with the Army team again on board, he lined up in the mile long track he had made and started his run. He could get to only 40 knots. He made a run in the opposite direction but couldn't get past 60 and could not unstick the nose ski. He made two more runs in each direction with identical results. Then he decided on JATO. Engines are never shut down on the cap so installation provided some fine chill factors. Since the direction in which he got the 60 knots was downhill the pilot made his JATO run that way. He finally got his nose off at just over 60 knots, could only accelerate to 68 and literally jerked the plane into the air.

Another little goodie involved a rescue of an Eskimo mother and

A stateside director of safety gets a look at a different kind of operation. Safety, perhaps, is relative, but the author is convinced that safety on the ice cap is spelled PRO!

The Ice Men Cometh

Lt Col Paul L. Smith, 839 Air Div (TAC), Sewart AFB, Tenn

her child on an island north of Baffin. Contact with the base was made by radio from the village where a snow strip was available. Fortunately, one of the old heads took the mission. This strip was on the coast and had a light covering of snow over the ice covered landing area. As the crew touched down and went into reverse, the skis cut through to the ice and torque began to turn the aircraft. The pilot immediately came out of reverse in 1 and 2 and finally added almost full power to them leaving 3 and 4 in reverse. After about 25 degrees of skidding left turn, the pilot regained directional control. Routine rescue! Incidentally, brakes not only are unnecessary, but use in a ski landing means buying a round for everybody on board.

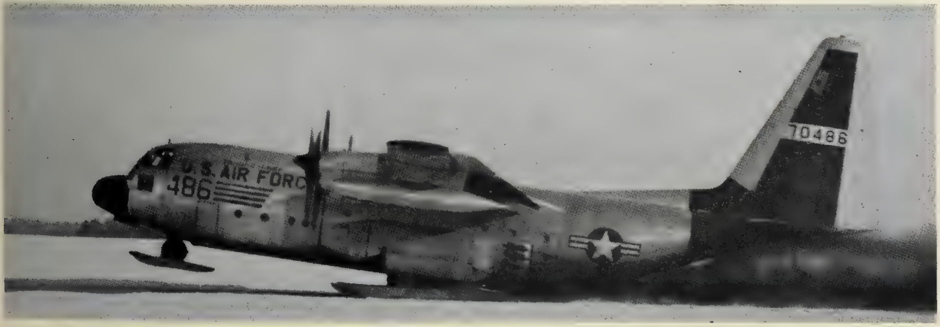
A third item of the kind which causes safety officers to totter over to the nearest wheel chair was a night takeoff at one of the cap sites. Snow was a little sticky — no JATO — and when the pilot reached the end of the runway lights, he only had 60 knots. Since crevasses are not usually found out here and the site personnel scout for them he elected to continue and get airborne after about another 2000 feet of run through the murk. Common occurrence up there!

In only eight days we could just begin to recognize the problems. The whiteout is a beaut! The snow on the cap and the clouds blend until there is no horizon. So there you are flying in the clear on instruments. You can also make your own weather. During landing on the cap, the engine vapors form into fog and can reduce visibility to practically nothing on the strip. Very disconcerting when you are trying to shoot transition. Airborne radar approaches are the rule rather than the exception and very effective because anything at all shows up on the scope. They even picked up a polar bear who was on an exact 90-degree track. Every time they would come over him, he turned north and as soon as the plane passed, zap — back to 90 degrees. Must have had a girlfriend on the east coast.

During the winter, extreme cold and short daylight hours are limiting factors. (It got all the way down to zero one night while we were there and went to 56 above, but that's not usual.) Daylight comes along about nine and it's dark by three. The sun doesn't shine on Sondrestrom in January because the base is in a fiord. Maintenance men have limited facilities and during *normal* winter weather have to face the chill factor constantly.

Crevasses in the cap can be the cause of sudden aircraft stoppage and thorough pre-landing dragging is a must. The crevasses are very much in evidence along the edges of the glacier. Parts, too, are a limiting factor with a supply line a few thousand miles long. You just don't keep a bench stock of magnesium castings at a detached site.

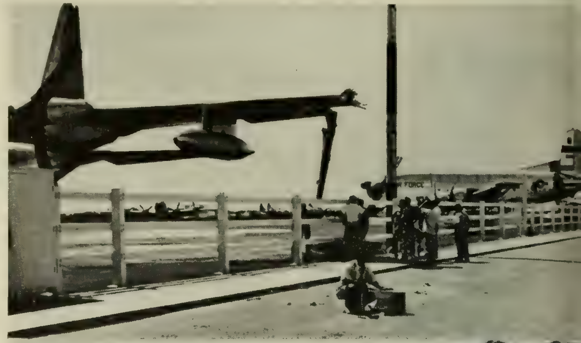
The 17th crews are among the best we've flown with. Whiteouts, radar approaches, those variable run takeoffs, etc., keep them real sharp. They don't get a lot of credit for the great job they are doing, but those boys on the glacier know them for what they are. A bunch of real pros! ☆

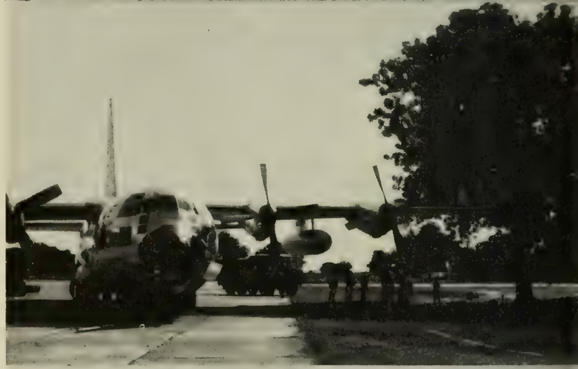


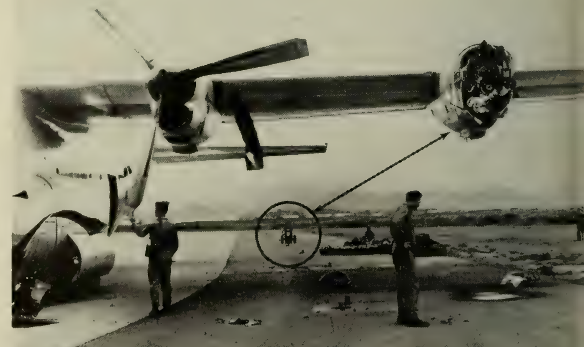
IT TAKES TWO TO TANGO

ONE AIRPLANE . . . . ONE OBSTACLE

Maj William M. Bailey, Jr., Directorate of Aerospace Safety







A taxi accident is unforgivable, yet take a close look at the pictures on this page. There are several ways of looking at these accidents. We MIGHT blame the guy who put that telephone pole near the taxiway and, of course, the fellow who planted, watered and nursed that tree for 25 years surely goofed. So did the airman who thoughtlessly left the fire extinguisher parked on the side of the taxiway, and the driver of the bulldozer. But, as they say, it takes two to tango!

Since the C-130 is my major concern, I took a look at the record and found that it has experienced one major taxi accident per year since 1962. Three in three years doesn't sound too unreasonable, considering the mission old Herkie is performing, but when we add up the dollars and cents plus the red faces the figure is somewhat astounding. Cost!! It turns out to average slightly under a million dollars per dance.

We have tried to figure out what causes these mishaps and why. Some of the headshrinkers say there is a built-in optical illusion, but you and I both know the only illusion that exists is complacency: complacency on the part of the pilot and complacency on the part of support personnel.

To avoid future mishaps and red faces there are two things you can do:

First, eliminate that old complacent attitude in the cockpit by taking a good look at the damage depicted in these pictures. (Incidentally, the bulldozer was hit by an aircraft other then a C-130.)

Second, consider the airfield your domain and if you spot any obstacles which may cause or contribute to a future taxi accident, report them, then make sure they are eliminated. *Insist* that support personnel provide the services of making the airfield safe for operation and you, in turn, help by *eliminating* complacency in the cockpit.

Remember, too, that the law (AFR 60-11) says that within 25 feet of an obstruction you gotta have a wing walker and within 10 feet you cut 'em and let the tug boys take over. ☆

MISSILANEA

REDUCING LEAKS IN G & C COOLING SYSTEM. Legends tell of a leak in a dyke which was plugged by the finger of a heroic Dutch lad. Conversely, Minuteman reports an "unplugging" procedure which lessens the chances for leaks.

Recent tests confirm suspicions that the carbon seal within the a-c pump of the G & C cooling system tends to become dislodged by the momentary surge in coolant pressure when the "by-pass to chiller" quick disconnect fitting is uncoupled during a c power operation. The carbon seals are spring loaded in the impeller housing to assure water tight contact with a minimum of wear. If the seal becomes cocked or displaced, leakage will result. Seal dislocations can therefore occur to pumps undergoing Strategic Missile Support Base test bench examinations, as well as pumps in operational installations.

T.O. 21M-LGM30A-2-6 has been revised to require shutdown of a-c power to the Liquid Cooler a-c pump prior to uncoupling the "by-pass to chiller" quick disconnect. Shutdown of a-c power will automatically put the system on d-c operation. In the d-c operating stage, a flow of approximately two pounds per minute will be maintained in the "to missile" line and the flow in the "by-pass to chiller" line will be reduced from approximately 20 pounds per minute to something less than two pounds per minute. This reduced flow will permit uncoupling the quick disconnect fittings without damage to the a-c pump seals.

Minuteman Service News
Boeing Aero-Space Division

THE DIESEL ENGINE WENT – BANG! Incorrect technical data that allowed the use of improper lubricating oil caused an explosion in the crankcase of a diesel electric generator at a missile site.

The generator was purring along under a light load when, bang! The explosion blew out the crankcase access ports and threw out burning engine oil which resulted in considerable fire and smoke damage to the facility.

Damage to the diesel engine included three piston pins badly galled and five other piston pins galled to various degrees. In addition, the bearings on one of the air blowers were scored, allowing the blower vanes to rub on the case and cause the blower shaft to break.

The following sequence of events, caused by the use of the wrong oil, resulted in the mishap: The piston pin carrier bushing and piston pin deteriorated, resulting in ignition temperatures in the crank case. The failure of the blower shaft permitted combustible vapors to accumulate in the crankcase. When the wrist pin became overheated, the vapors ignited causing an internal explosion in the crankcase. Luckily, at this particular missile installation, the diesel electric generator was located in a facility remote from the silo. Had this diesel engine been in a silo, the explosion and fire probably would have resulted in the destruction of the missile and silo facility.

The present trend to standardize and reduce maintenance on diesel electric generators will surely aggravate conditions which brought about this explosion. Responsible personnel should take immediate and positive steps to assure rigid compliance with the manufacturers' maintenance requirements. Otherwise, incidents of this type will be repeated at other sites as diesels become more worn.

During the incident investigation, many maintenance requirements deficiencies were encountered. A number of these deficiencies are listed below:

- When the daily checklist was accomplished, unusual conditions were not entered on any of the maintenance forms. This caused a breakdown in the chronological maintenance history designed to insure that all deficiencies are reported and corrected.
- Maintenance Record Equipment AF Form 1317, listing periodic inspection requirements, did not include all items required by the manufacturers' data.
- The maintenance history recorded on AF Form 1167, "Daily Power Plant Operating Log (diesel-electric)," was incomplete. The log books kept by operating personnel contained a great many entries concerning problems encountered with the diesel generators which were not recorded on the official maintenance records. Many problems encountered with these engines were not brought to the attention of responsible personnel due to laxity in maintaining records.
- Operational requirements overrode maintenance. Several cases were cited where scheduled maintenance was deferred due to operational requirements.
- Conflict of technical data was revealed in that one Technical Order (T.O.) called for SAE 30, Mil Spec L-2104, oil while another T.O. containing engine requirements called for an SAE 40 oil with less than 25 parts per million (PPM) zinc present. The zinc content of the Mil Spec L-2104 oil used was found to be in excess of 1000 PPM.
- Maintenance records did not show oil changes every 2000 hours and filter changes every 1000 hours as required by the manufacturer.
- Quality control surveillance consisted of housekeeping type inspections. Hardware spot checks were not being accomplished because a power plant specialist was not assigned.

As a result of this incident, the other diesels at this base were thoroughly inspected, cleaned, and replenished with proper lubricating oil. This should help to assure that another incident will not occur to these engines.

Carl S. Norstedt
Directorate of Aerospace Safety

Aerobits

SLEEPY PEOPLE?—Here's one that, if fiction, no one would believe. The jet jock inbound in No. 2 spot after a night formation mission, doesn't remember lowering the gear. He also can't remember whether or not the unsafe lights were glaring back at him from the instrument panel or if the horn was blowing.

Down near the approach end, the mobile runway control officer, stationed where he is to watch for such things as gear up approaches, failed to notice or comprehend the meaning of the fact that the nose gear taxi light was not on during the approach. Now, in this aircraft, the nose gear taxi light will not illuminate unless the nose gear is fully extended for landing. And, because of this, the organization concerned has stipulated that the mobile control officer watch for this light as a sure sign the gear is down and locked.

But, to take care of the remote possibility that a pilot would forget to lower th gear *and* the mobile control officer woul forget to check the lights, another man— the mobile control officer's assistant—i also stationed in mobile. Yup, he misse it, too.

Well now, as if this were not enoug lethargy, more unbelievable events are ye to transpire. The aircraft made what wa described as a "normal" touchdown an slid straight down the wet runway fo 4000 feet on its pylon tanks.

Now, at last, comes the awakening.

It wouldn't taxi!

Approximately three man hours wer required to jack the aircraft, drop th gear and tow the bird to a hangar. Si man hours were required to magnaflux th pylon tank racks and replace the tanks.

The man hours required to erase th chagrin on the part of those involved wa not reported.

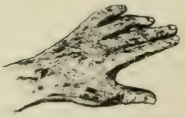
WHY SAFETY BELTS?—Auto seat belts have been getting a lot of publicity, but those in aircraft are pretty much taken for granted. The result of not using belts in either case might be serious injury or death.

Recently a transport aircraft was flying at 11,000 feet in what appeared to be stratus clouds. As letdown began, it ran into severe turbulence. Since their seat belts were not fastened, the loadmaster and passengers went flying around the aircraft. All were injured, one of them fatally.

A similar incident occurred when an aircraft was flying at what was thought to be a safe distance from a squall line. In anticipation of turbulence, the seat belt light was turned on, but only light to moderate turbulence was experienced as the aircraft passed abeam of the squall line. No radar returns were being recorded, except one buildup a considerable distance from the aircraft, so the crew began to move around. Two of them suffered broken ankles when the aircraft encountered a violent updraft.

When flying in or near clouds and frontal areas, crew and passengers should be seated with safety belts fastened, and aircraft commanders should insist on this.

Lt Col Garn H. Harward, USAFE



WEAR GLOVES—A major accident vividly portrayed the importance of wearing gloves while flying. Two crewmembers escaped the flaming wreckage. One crewmember wearing gloves received minor burns on one hand. The other crew member was not wearing gloves. Both o his hands were burned to the extent tha permanent deformation will probably result.

HOW TO BREAK TIRES—As the T-29 crew was completing the prelanding checklist, the hydraulic pressure was noted at zero, indicating a failure of the main hydraulic system. While on the base leg, the IP instructed the pilot to place the emergency air brake knob in the "HOLD" position. Upon touchdown (or shortly thereafter) all four main gear tires failed. The aircraft traveled approximately 2000 feet and rolled off the side of the runway.

The Dash One states that when the air brake knob is operated to the HOLD position there should be no braking action. Conjecture is that the system could have been activated by the knob being turned slightly beyond hold, or momentary malfunction, or by vibration on touchdown.

But, the Dash One procedure also points out that in such a situation, reversing should be used during the initial high-speed ground roll since the use of air brakes at that time may cause wheel locking and tire damage. The emergency air brake system should be reserved for final slowing and stopping of the airplane. Extreme caution is advocated when using reverse thrust on landing with loss of hydraulic brake pressure and/or hydraulic system pressure due to the loss of nose-wheel steering. If only one propeller should reverse, the procedure is to close the throttles and allow the airplane to roll down the runway until the ground speed has reduced sufficiently to allow operation of the emergency air brakes without danger of wheel locking and subsequent tire damage.

IMMELMANN, "THE HARD WAY"—This T-33 was airborne on a pre-solo student transition flight. Normal airwork was accomplished and after the tips were empty, a few acrobatic maneuvers were performed. The IP then took control of the aircraft and headed for home to enter the traffic pattern. While descending through 12,000 feet, airspeed 270 KIAS, the IP ran in about ¾ full nose-down trim in order to give the student a simulated run away trim condition. He told the student to take control of the aircraft. As soon as the student shook the stick, indicating he had assumed control and stated that he had the aircraft, the IP abruptly released the back stick pressure he had been holding against the nose-down trim. The stick immediately popped from the student's grasp and the aircraft nosed over violently to a near level inverted attitude before the IP could regain control.

Recovery from this inverted flight attitude was completed at approximately 7000 feet. The front cockpit accelerometer indicated 4.5 negative G had been encountered. An emergency was not declared. The landing was executed without further incident. Subsequent overstress and aircraft alignment checks revealed no discrepancies.

ATC's "Approach to Safety"

JET BLAST AND THE BARRIER — What's the hole doing in the bottom of the wing fuel cell? Could it be from a bird strike, foreign object damage or collision with an unknown object? Well, it turned out to be the result of striking an intermediate MA-1 barrier stanchion, on approach for landing.

It happened this way. Just prior to a fighter landing, a four-engine, jet transport taxied onto the runway 400 to 500 feet in front of the barrier and made a pre-takeoff runup. The blast from the run-up although the craft was past the Start-Here sign, blew the webbing free of the stanchions and allowed the stanchions to raise. Two points here to note: Don't come in too low over the end of the runway, and barrier crews must be sure to make frequent checks for raised barriers where barriers are subject to jet blasts from multi-engine aircraft.

Harrie D. Riley
Directorate of Aerospace Safety

Aerobits

LOSS OF CONTROL ON LANDING ROLL — After 1500 feet of uneventful landing roll, the pilot of a B-66 lost control and damaged a right wingtip when the aircraft veered off the runway. Everything was OK except the pilot's crosswind landing technique. The aircraft started weathervaning upon deployment of the drag chute. The chute was not jettisoned when control became marginal, and complete loss of control resulted.

Lt Col Eugene J. Budnik
Directorate of Aerospace Safety

OLD CHUTES — A B-47 being ferried to storage was landed without use of the approach chute. The aircraft then skipped 1000 feet before the pilot got it firmly on the ground. When the drag chute was deployed, it failed. Subsequently a tire blew and the aircraft rolled 1000 feet past the end of the runway.

The chute, which had seven broken shroud lines, two panels ripped completely out and five torn from top to bottom, was manufactured in 1955 and, according to the records, had been repacked last in December, 1961.

The fact that this aircraft was going into storage does not mean that it should be provided with unserviceable equipment. Failure of a drag chute can be fatal.

THUD! SOMETHING'S MISSSING—At 27,000, during cruise, the crew of the C-120 noticed a slight flutter of controls, an airspeed drop of three to six knots, then a solid "thud." The aircraft then began a series of pitchup and tuck maneuvers. Airspeed was reduced, the autopilot disengaged, an emergency declared and vectors requested to the nearest base. Landing was made at a municipal field in Kansas and the right wing outboard raft was found to be missing. ☆

FALLOUT *continued*

determine mental and physical capabilities to operate a vehicle.

3. Let's make it a mandatory requirement to install and utilize seat belts at all times; the driver in command of the vehicle could be legally required to shoulder this responsibility for compliance by occupants as is the case in aviation.

4. Let's increase our training, testing and law enforcement personnel departments to an adequate level whereby preparation for vehicle operation, maintenance and demonstration of proficiency at yearly intervals, with removal of incompetents and non-adherents from the role of licensees to be accomplished promptly and permanently when warranted.

We, in aviation, have had this type of program for many years; the railroads are very meticulous in the operation of their equipment. These programs have proven their merit without degradation of capability.

A national program is in order. Let's do something about it.

Lt Col Stephen D. Kost
92d Strat Aerosp Wg (DCOCE)
Fairchild AFB, Washington

NEAR ACCIDENT

Just though I'd drop you a note about an incident that happened to me. It did NOT occur in a military aircraft.

Let me set the scene: 5000-foot runway covered with patchy snow, landing weight 41,000 pounds, crosswind component 13 knots, GCA approach with a 4-degree glide path and transition to land on a parallel runway (GCA runway closed for repairs).

We were a little hot and a little high (sound familiar?). We used full flaps and the power was reduced to idle. The pilot was still applying pressure to the throttles against the reverse stops as we dropped in and bounced. Both engines started to go into reverse as we became airborne again. I was in the right seat, as copilot, and I hit the yoke with my knee to push the nose down when I heard the props going through flat pitch. The second contact with the ground was a little rough but no damage resulted.

The cause of the reversal was the pressure being applied against the reverse stops when the aircraft contacted the ground the first time.

This is one of those sets of circumstances that build up to an accident. I thought you might be able to prevent recurrence of this type of thing if I gave you the word.

Name withheld at writer's request.

SIXTY THREE ARRESTS

I have read the article "63 Arrests," page 25 of the October issue, and have a question regarding the chart titled "Causes of Failure to Arrest By Type of Aircraft." It shows that the speed brakes on an F-101 aircraft deflected the arresting cable. How could the cable be deflected by the speed brakes on this aircraft when they are located on both sides of the fuselage aft of the afterburners? Could this have been a misprint and meant to be the F-100 aircraft?

SSgt Robert M. Lydon
81 Org Maint Sq, Box 35
APO 755 New York, N. Y.

You're so right—it is an error. We failed to detect a typographical error in the Stat Report which we used.

★★★★★★★★★★★★★★★★★★★★★★★★★★★

CORRECTION

Chopper Zones—The color overlays on pages 14 and 15 of the November issue were inadvertently switched. We ask that readers ignore the color markings but observe the approved zone instructions: desired, acceptable, prohibited, and caution.

WELL DONE

CAPT. JAMES H. ELLIOTT

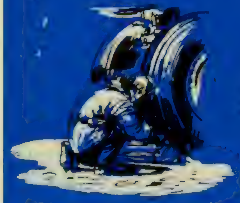
1ST AIR COMMANDO WING, HURLBURT FIELD, FLORIDA

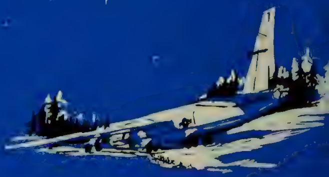
Captain James H. Elliott has been awarded the USAF Well Done Award for the manner in which he handled an emergency while flying an A-1E. At 9000 feet, approximately 25 miles northeast of Crestview, Florida, Captain Elliott noticed smoke in the rear compartment of his aircraft; however, fire could not be detected in the hell hole by the crew chief. The pilot immediately headed for home. Approximately three minutes later, the manifold pressure dropped to 17 inches Hg. All other instruments were normal. Captain Elliott attempted to determine the nature of his problem and regain power while making a slow descent to land at Eglin Auxiliary No. 3, but soon after starting descent, oil pressure dropped to zero and all power was lost. Being near Crestview, Captain Elliott established a forced landing pattern for the new airport there. He lowered the gear at the high key, flaps on base leg and completed a successful landing. Investigation revealed that a broken oil line between the front and rear sump caused the loss of oil and subsequent engine shutdown.

Through his knowledge and skill, Captain Elliott averted a possible loss of life and saved a valuable aircraft. WELL DONE!

WOOD CHOCKS and BOMBERS

'Twas the night before Christmas
And on alert stubs
The snow was as deep
As ferris wheel hubs.
The ground crews maneuvered
The bombers around
In hopes they could find
Some fresh snow plowed ground.
The tow supervisor did find some wood chocks
To place 'hind the wheels so the ship would not rock.
But the ground, it was slippery
And chocks, they did slide
And the B-52 started downhill to ride.
Some three hundred feet
Did this bomber so go
'Til it suddenly stopped
In a ditch filled with snow.
The moral is simple
As tow crews now know.
Wood chocks won't hold bombers
A slippin' on snow! ✶





Lt Col David J. Schmidt
Directorate of Aerospace Safety

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AEROSPACE SAFETY

UNITED STATES AIR FORCE

JANUARY 1965

ZERO-ZERO

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AEROSPACE SAFETY

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AFRP 62-1 JANUARY 1965 VOLUME 21 NUMBER 1

FALLOUT

FOR WANT OF A WARNING

"For Want of a Warning" (October) pa allels an F-100 accident of two years ag At that time the use of runway abort sig nals was proposed through the Air Forc Suggestion Program and disapproved. Th idea was not original and two types hav been seen. In 1957, Duluth installed an "Abo Light" a thousand feet down the scrambl runway. It was turned on to stop a scramble Around 1959, another base, perhaps McCle lan, had remote operated flares 5000 fe down the runway. They were fired whe any aircraft had an observed malfunctio during takeoff.

Kick the idea around in Safetyville and r fine it—or throw it out in the field, raw! It not perfect but it's simple and cheap enoug for local funding. We don't have to los birds "For Want of A Warning."

Maj Guy C. Cisco Jr
Chief of Maintenance
32 FIS, APO 292 New York

RADIALS vs. MAGNETIC HEADIN

Approximately ten years of experience hav been garnered in planning, directing an flying aircraft by use of radials rather tha headings.

I have yet to meet the pilot that wi admit he really prefers use of radials to mag netic heading, and I meet dozens of jocki who are spring-loaded in the verbose p sition to enumerate the pitfalls of directin the aircraft by the use of radials.

The most common complaint is the one a ditional arithmetical gymnastic required to co vert a radial to a heading. Transposition not a natural reaction. True, subtracting adding 180 degrees doesn't require a math matical genius, especially in an air-con tioned center, but when letting down I through mountainous terrain at night wi moderate turbulence, nothing could be mo disconcerting than to be carrying out yo previous acknowledged instruction of d scending on a heading of 247 degrees, som where near 1000 fpm, and have some co pletely unbiased controller proudly announ that you are now cleared to 5000 feet, i tercept inbound radial of 067 and interce a fix that may well be in Lower Slobov rather than the intersection of two we known VORs in the Southern Sierras, an establish a non-standard holding pattern, et

Your first reaction is to bend her ha to the right, when, if you're lucky enou to have a smart copilot or navigator, he ve gingerly touches you on the shoulder, an in a very ingratiating tone, asks, "Where a you going, Boss?" Or if you are drivin along in a one-seat bird utilizing high al tude charts, you quickly grab the knee pa for a fistful of low altitude charts and fl frantically through the assorted documents find the frequencies required to identify th nebulous intersection. All of which tends distract you from the primary mission of fly

continued on page 2

FRONT COVER PICTURE

A zero altitude, zero airspeed ejection sy tem is shown during a demonstration by t manufacturer, Weber Aircraft. Photo cred San Diego Union-Tribune.

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

"The IPIS Approach," is a new feature in AEROSPACE AFETY magazine. It's an Instrument Pilot Instructor School PIS) idea. "We get letters," they say, "and all of these tters have one common denominator—the need for more formation on instrument flying. Because one of our missions USAF IPIS is to standardize and promote techniques of strument flying in the Air Force we have developed this olumn to aid the flow of information—in both directions.

"We want your questions and comments on all aspects of instrument flying, including flight instruments, navigational aids, weather, flight planning, regulations and publications, procedures, technique, or any other area."

Following is the first column. How valuable this column becomes is entirely up to you, the reader. Send your question to Air Training Command, Attn: IPIS, Randolph AFB, Texas, or to the Editor, AEROSPACE SAFETY magazine.

Q. Should the pilot plan to be at e holding fix or the initial ap- roach fix (IAF) at the expected pproach clearance time (EAC)? Example: England AFB, La.)

A. For TACAN holding where e IAF is not located within the ublished holding pattern, the attern should be adjusted so as to be at the published point of departure from the holding pattern at the EAC.

Where the IAF is located within the published holding pattern, the pattern should be adjusted so as to be at the IAF at the EAC.

A different procedure is necessary when two-way radio failure is experienced during TACAN holding. If this occurs, you should be ready to begin your approach at your EAC, whether the IAF is located within or outside the TACAN holding pattern. In other words, if at all possible, be at the IAF at your EAC with two-way radio failure.

Q. Is it legal to perform a pene- ation on a VORTAC facility using ACAN only when it is published s a VOR approach? (Example: marillo AFB, Tex.)

A. The correct response to this uestion centers on the word ompatible" as used in paragraph 0c, AFR 60-16A. There appear to e two viewpoints as to what constitutes "compatible" navigational equipment — those of the pilot versus those of air traffic controllers. Since the facility is a VORTAC, the aircraft's TACAN equipment is capable of providing adequate navigational guidance for the penetration and approach. Therefore, it is logical for the pilot to assume that his equipment is "compatible." From an air traffic control viewpoint, a pilot can not be cleared for an instrument approach unless it is published. In the absence of a published TACAN or VOR/TACAN approach, there is no assurance that such a procedure has been flight checked and approved. The only safe answer is that a penetration and approach using TACAN in lieu of VOR is not authorized.

POINT TO PONDER. You have lanned an IFR flight with a total istance to destination and alter- ate that is approaching the max- num for your type jet aircraft. The eather forecast is such that IFR nditions will be encountered roughout the flight. You file for L 350, specify a Gin Mill #2 D; and then call for your clear- nce after arriving at the aircraft. he clearance you receive reads: TC clears AF jet 12345 to the omsville Airport, via Gin Mill tersection, direct Blotsburg VOR, ight planned route. Maintain FL 30. Expect further altitude change route. Gin Mill #2 departure. laintain 4000 until 13 miles utheast. Reply Mode 3, Code 10. Contact Orville Departure Control on 397.2 after airborne."

Would you accept this clearance? Several factors must be considered, especially since you're pushing your maximum range for fuel on board.

- Can you make it all the way to destination at FL 230 if you lose two-way radio communication? Your clearance assigns you an altitude in the highest route structure filed, so you have to maintain that altitude. If you can't make it, don't accept the clearance.

- Suppose that your original clearance specified that you maintain 17,000. Since this is not in the highest route structure filed, you really have a problem if you lose two-way radio communications. ATC has not, in this case, given you an expected altitude so you are expected to maintain 17,000 until you are ten minutes beyond the first compulsory reporting point; then you climb to the lowest cardinal altitude (thousand foot levels) at or above the MEA of the highest route structure filed — THAT'S FL 180. Can you make it to your destination?

We think your best procedure would be to refuse the clearance unless it is specifically amended to include an altitude to which you can expect to be cleared at a given fix or time. Then if you lose two-way communications you have an altitude assignment which is compatible with your flight.

These are only a small sampling of the type of questions e receive continuously. Some are complicated, others are ot, but the important thing is . . . some pilot was interested enough in his profession (and his neck) to ask the question. So it's up to you to make sure that "We Get Letters" and we guarantee "You Will Get Answers." ☆

LIKE A ROSE . . . .

A Plane Is A Plane Is

THIS GOES FOR THE LITTLE FELLAS, TOO.

The old boxing axiom "The bigger they come the harder they fall" may be apt for fisticuffs but hardly applies to airplanes. Experience over the past few years indicates that a more accurate saying in reference to USAF utility aircraft would be something like "as small as they are, they still fall pretty hard." The U-6's, U-10's and U-3's haven't been getting as much publicity as their bigger and faster brothers, but they have been involved in a flock of accidents costly in both lives and equipment.

There are a lot of reasons for these accidents — almost all are tagged with a specific cause factor —but too often the reasons do not seem compatible with the image of the professional Air Force pilot. What are the real reasons? Complacency? There's a word that has been kicked all over the lot. Are pilots who are accustomed to flying bigger and faster equipment overly complacent when they get their hands on the controls of a U-3? Perhaps. Careful study of these accidents, however, leaves considerable doubt as to pinning the blame on the vague term complacency. The closest answer seems to be lack of pilot proficiency or in plainer words: heads up and locked piloting.

Take the fellow that ran his blue canoe out of petrol at night with three passengers aboard. He demonstrated a high degree of proficiency in being able to make a gear up landing at night in the snow. There was some doubt, however, as to his ability to flight plan and manage his fuel. Lack of judgment seems to fit this case like a perfect 36.

This flight started out at Point A and proceeded to Point B, where there was a lack of alacrity on the part of transient maintenance in putting gas in the tanks. The crew decided they had enough anyway so they didn't wait around for the gas truck.

They flew back to Point A, where they didn't land but made a turn north and continued on to Point C where one of the pilots was offloaded. No gas was obtained there. The remaining pilot then took off and headed back to Point A. About 20 miles from Point A he became extremely concerned with his fuel situation. So he did a 180 and headed for Point D, a civil airport between Points A and C. The fact that D was 40 miles away compared with 20 miles to Point A didn't occur to him. Six miles short of Point D the tanks went dry. You know the rest.

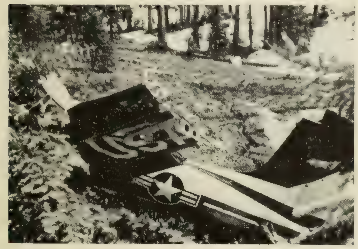
There were a whole bunch of discrepancies in this pilot's statements about fuel consumption: He said that on one leg it was 19½ gph. On another leg it was just a fraction of a gallon higher, but on the third leg, WOW! That U-Bird was gulping it up at nearly 46 gph.

Investigators took a look at this seeming paradox and also had the gages tested. Their findings: the gages were right on the money, in fact more accurate than most. The pilot tried to fly a 138 gallon flight on 132 gallons of fuel.

MOUNTAINS AND CANYONS

There have been some cases in which pilots flew into mountainsides with the loss of all aboard. One got himself into a canyon he had no business being in and couldn't get out. Another — well,

Plane



nstead of going into all the details ve'll put it into the context of a roblem. See if you can figure out vhat happened from the recomiendations made by the accident ivestigation board. "Recommend ie importance of the following be ressed:

- "Maintaining exact airways avigation.
- "Utilizing all available naviation equipment.
- "Being positive of position rior to accepting descent and aproach clearances."

After investigating the mishap in vhich the aircraft was trapped in a anyon, the board tagged the pilot vith the accident because he atempted to fly a VFR course rough mountainous terrain durig marginal weather conditions. One of the recommendations seems have a lot of sense to it. In ssence airdrome officers and disatchers should place more emhasis on advising pilots of hazrds, particularly when they will e departing airways and crossing ountains. Meeting incoming airraft is commendable, but saving ves is more important.

Then there was the fouled-up pisode in which three pilots fially totalled out their aircraft but ianaged to walk away with no erious injuries. These fellows were ying a U-3B when they decided to nd at a civil airport and take on ome fuel, because the winds were tronger than expected. They got as and put a couple of quarts of l into Nr 2 engine. This made ense, but what follows—you be ie judge.

Despite a SIGMET warning of evere turbulence due to high vinds and an enroute station reporting three miles with rain showers and fog, they filed a VFR flight plan. Takeoff was late in the evening, pretty close to dusk. Twenty minutes later the aircraft was forced down to 3500 feet by a stratus layer so they decided to return to the airport where they had fueled. During the turn Nr 2 RPM fluctuated and there was a 10 psi oil pressure drop. The other gages read okay so the pilot didn't get upset. About five minutes later the RPM started jumping between 1200 and 2700 and oil pressure went to zero.

During this fluctuation the pilot noted that Nr 1 RPM was lower than Nr 2 so he feathered Nr 1. Immediately Nr 2 froze. Obviously this called for some kind of action, so Nr 1 was brought back in. Feathering Nr 2 proved to be impossible so the RPM on Nr 1 was advanced to 2450 and the throttle to 24 in. Hg in an attempt to hold 110 mph. Altitude now was 2500 feet. Full power was now selected; even so, the aircraft was unable to maintain altitude and airspeed, primarily because of the turbulence and maneuvers to avoid hitting the hills.

Now the aircraft was at 1500 feet, down in a valley formed by a 1700-foot ridge shaped like a horse shoe. At this point the decision was made to make a forced landing and give up the attempt to make it back to the airport. The gear up landing was smooth but ground undulations and a fence damaged the aircraft to the extent that it was considered beyond repair.

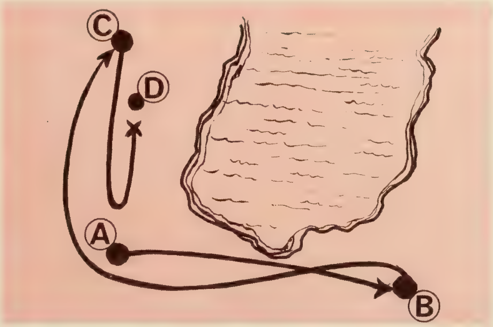
One could argue that the primary cause for this accident was engine failure. On the contrary, pilot factor could be considered the cause, which is the way the board decided based on the following:

- Failure to identify the failing engine which would have permitted feathering prior to seizure.
- The pilot feathered the wrong engine.
- Failure to establish maximum power immediately after restarting Nr 1 engine.

There were a flock of contributing causes ranging from materiel failure within the Nr 2 engine to some more omissions and commissions on the part of the pilot.

INSTRUMENT ERROR

Now consider the case of a hard landing in a U-3. This can happen to anybody. You bet, but this one



Poor planning for this flight resulted in forced landing at night in cornfield. Pilot tried to fly 138-gallon-flight on 132 gallons of fuel.

"Even the smaller airplanes the Air Force has take a tragic toll."

got a little complicated. Seems this man was flying an aircraft in which the airspeed indicator was known to have at least a 10 mph error on the high side. It had been released for flight with this condition.

The pilot hadn't flown the canoe for several months so he got a one-hour checkout and then went up solo. In the pattern he called the tower and was given his choice of two runways, one 5000 feet long and the other 2500 feet. Naturally, he chose the short one. He was a little high on final so he chopped the throttle to 12 inches. Wind was light and he maintained 95 mph indicated to flare. When the aircraft was flared at 30 feet above the ground two things happened simultaneously: the stall warning blew and the aircraft stalled completely. It came down hard on the left gear, bounced onto the nose gear and then the right gear. Fortunately the thing hung together and the pilot taxied it to the parking area. When they got around to looking the bird over, it was found that it needed a whole list of things including a new left prop, left engine, left gear, brakes and tire, wing panel, etc, etc.

During his checkout the pilot had been warned of the error in the airspeed indicator. Actually the error was greater than reported (as discovered in later tests) and when the aircraft flared for landing it was right on the edge of a stall. At rotation for landing, out went the bottom and down went the airplane.

Now the owner of the pilot and the owner of the aircraft were not the same. The investigators were on the pilot's team and they found that the primary cause was maintenance error, i.e., release of the aircraft with a known airspeed indicator error.

The owners of the aircraft saw things differently; they seemed to feel that the pilot had ample warning of the error, that he failed to compensate for it and therefore was to blame. You pay your money and take your choice.

Sometimes a pilot gets boxed into a situation where the outcome might depend upon luck as much as skill. One night awhile back a U-10 was taking off from an unlighted strip. In the right seat was another pilot along as an observer; in the rear was a passenger who had been picked up at the strip as part of an exfiltration mission. Just after takeoff, when the aircraft was at about 200 feet, the engine lost power. The aircraft was in a shallow turn to the left. The pilo quickly turned back to the right fo an attempt to land on the remaining runway. The aircraft hit bounced, rolled across a road an into a clump of trees. There wer no injuries.

Although the exact cause of thi accident was never determined b the board, the most probabl cause, according to the investigators, was that the right seat observer accidentally turned the fue control partially or fully off wit his foot when he turned around t assist the back seat passenger ge aboard and strap in. (The majo air command determined the caus to be pilot factor, in that the pilo turned at too low an altitude an hit the trees.)

Brake failure, the kind that give one that helpless feeling, resulte in two accidents involving three U-3s. In one of these the right brak failed and the aircraft ran into curb along the edge of the parkin area. The other one was a littl more serious in that a U-3 bein taxied to the ramp collided wit another U-Bird causing extensiv damage. In this case, it was determined that overheating caused b excessive braking during landin and taxiing caused the brake to fail

Even the smaller airplanes th Air Force has take a tragic toll. few minutes after takeoff the engine of a U-6 appeared to witnesse on the ground to lose power. Th aircraft descended to within 15 feet of some trees then seemed t regain power and begin a climb. I levelled out for a short distance an a left turn was begun. The nex observer saw the aircraft in a descending left bank with no apparen power although the propeller wa rotating. By now the aircraft wa just clearing the trees. The engin appeared to start then the aircraf struck a tree, went into a stee right bank and finally crashed afte striking more trees.

Whether the engine failed or th pilot was simulating forced landings is unknown. The Board concluded that, if the engine wa malfunctioning, the pilot used poo judgment in not making a landin at the first sign of trouble. Even i the engine came back in, it was no wise to continue flight over a hill wooded area with an engine tha was malfunctioning.

If the original low approach was) simulate a forced landing, then oor judgment was exhibited in naintaining flight at such a low ltitude that when an actual mergency occurred there was no naneuvering room.

Even though materiel failure of ne engine might have been involved, the most probable cause of nis accident was determined to be ilot factor either because of poor idgment or because of the possiility of the pilot failing to roperly clear the engine after ower reduction during a simuated forced landing.

One more example before conluding this summary: The pilot of U-10 took off on a 2500 foot strip t 4300 feet elevation. Take off run ras about 600 feet. The pilot reuced RPM and about 10 seconds ater decided that he could not lear a bunch of trees straight head nor could he avoid them by turning. He raised the nose and just prior to impact closed the throttle. Was the fact that no one was injured due to pilot skill or pure luck?

These are just a few examples, selected at random from the approximately 30 accidents in which light aircraft have been involved during the past two years. Some were the result of factors beyond the pilot's control; most, however, were caused by the actions of the pilot. This hardly agrees with the image of the Air Force pilot as a professional.

Paradoxically the pilots involved were successful in flying much more sophisticated aircraft. Why then did they prang the little birds?

These accidents indicate that checkout procedures have not been thorough for some pilots of utility aircraft. There also appears to be a tendency toward an attitude of "I can get away with it" that would not appear in respect to larger, faster aircraft.

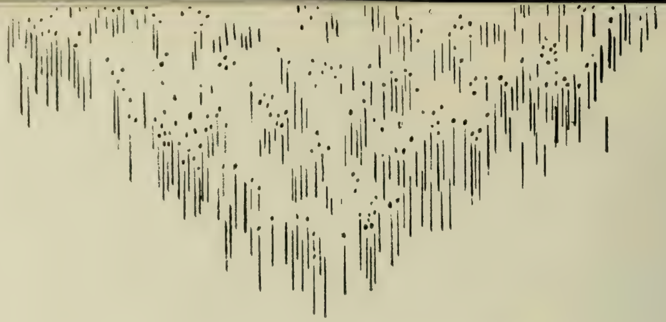
Review of light aircraft accidents indicates that pilots don't thoroughly study the Dash One. Emergency procedures and performance data are important regardless of the size of the airframe. The physical laws governing aircraft performance are the same for a Mach 2 fighter, a jet bomber or a U-3. Ignore them and you're in trouble, regardless of the aircraft type. Treat the little birds with the same respect you give their big brothers and they'll respond likewise. Show them contempt and they're liable to repay you in kind.

Correction of these two items, insufficient checkouts and lack of respect for utility aircraft, can prevent many of these needless and sometimes fatal accidents. ☆

Robert W. Harrison

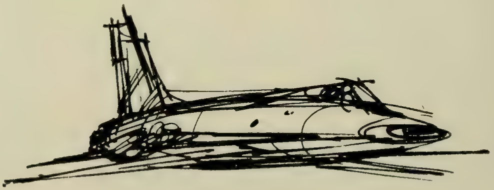
AGAIN... USAF WINS SAFETY COUNCIL AWARD

esentation of the National Safety Council Award of Honor to the Air Force is made to Secretary Eugene Zuckert by Howard Pyle, President of e National Safety Council. Other persons attending the presentation are (L-R): W. G. Weller, Office of the Inspector General; Vice Chief of Staff, eneral John P. McConnell; Secretary Zuckert; Mr. Pyle, and The Inspector General, Lt General Keith K. Compton. This is the fourteenth consecutive ar that the Air Force has won the National Safety Council Award of Honor. Four Air Force Commands received the award: USAFA, CONAC, MATS and C. The award is based on military and civilian fatality and injury rates, Air Force motor vehicle accident rate and accident cost index.



MORE ALIVE in '65

Each year's safety program in the Air Force is based, to a large extent, on recommendations made at the Annual Safety Congress. This article relates the highlights of the 1965 Congress held at Maxwell AFB. Here are proposed safety planks of the platform for the 1965 campaign.



FLIGHT SAFETY

Improved accident investigations will result if the objective of Flight Safety Seminar No. 1 is achieved. Safety surveys, staff assistance visits and accident reports coming into the Directorate of Aerospace Safety indicate that accident investigations need to be improved. If you do not have one now, the word is, prepare a pre-accident plan. This plan should spell out individual and agency responsibilities, require board members to be placed on orders, insure that other duties will not interfere with active board members' obligations and delineate support obligations. A pre-accident plan, developed at the congress, is expected to be distributed to field units for their use in preparing their own plans.

Because civil authorities often reach the sites of off base military accidents prior to military investigators, an educational program is being prepared to better acquaint such authorities with assistance they can provide. Letters and brochures are to be sent to all bases. The Directorate of Aerospace Safety, in conjunction with the Army and Navy safety centers, is working on a film to be used in this program. Help from civil authorities and preplanned and trained investigation boards are expected to aid in reducing the number of "undetermined" category accidents.

Another area, better reporting and analysis, is to get more emphasis during 1965. As was pointed out during the seminar, facts discovered but not reported have little value in the accident prevention program. Commands are asked to conduct extensive educational campaigns on proper preparation of accident and incident reports, operational hazard reports, emergency unsatisfactory reports, quality control deficiency reports and unsatisfactory reports. The Directorate of Aerospace Safety plans to support this campaign in the safety education publications. This will also be a special subject in 1965 during staff assistance visits and afety surveys.

Last year a new AFLC organizaion, the Materiel Safety Center, vas established and partially manned. Under this concept safety problems associated with materiel deficiencies are more expeditiously identified by AFLC and directed to an appropriate agency for correction. The consensus of seminar members was that this approach should be more effective than the Top Ten program (outlined the top ten materiel deficiencies of each major command) and that Top Ten should be dropped. A drawback to the Top Ten program was slow or incomplete action to overcome reported deficiencies.

Another major effort area proposed is an all out drive to improve quality at all levels, from Flight Line Maintenance to the AMA's and to Industry. Quality Control is scheduled to be a special inspection subject. Seminar members went on record recommending that AFSC and AFLC should act vigorously and expeditiously to insure improved quality.

Fire warning system troubles are in for added emphasis. The special seminar set up to explore this area contended that timely warning of overheat and fire is of vital importance to aircrews and that deactivation of the system is not the answer. System modification, better maintenance of present systems and development of new concepts and systems are suggested.

The excessive backlog of Time Compliance Tech Orders is in for a hard look. In some cases, the delay in accomplishment permits the T.O. to be rescinded before it is complied with. The report explains that the problem is compounded by the existing TCTO backlog coupled with maintenance manpower shortages, insufficient aircraft downtime and a reluctance to issue Safety of Flight T.O.'s.

Since statistics show an increase in maintenance-induced accidents, this area too is expected to receive special attention in '65. Changes anticipated include a motivation program aimed at overall improvement of maintenance practices. Maximum monthly or weekly duty hours are recommended (an approach similar to the crew duty hours limitations for aircrews). Commanders are urged to establish programs to more adequately recognize the contributions of maintenance personnel. Increased maintenance manning is sought in view of current trends in maintenance factor accidents.

GROUND SAFETY

Industrial, traffic and explosives afety were the three principal reas investigated by delegates and hese are the areas expected to eceive special attention in 1965. In ddition, special subjects included reas of sports and recreation, milary field exercises and safety prorams.

Implementation of "Problem riority Profile," a managerial echnique which looks at the inustrial safety problem on a priory basis, is urged for each major ommand, with results to be reorted at the next safety congress. ecause of the many processes involved in Air Force industrial activity, this profile approach is proposed as a means of coping with the myriad industrial accident problems.

Again, because vehicle accidents continue to be the main cause of personnel losses in the Air Force, this problem was a major agenda item. For 1965 a 40 point program called "USAF Private Vehicle Action Program" has been prepared in an effort to most efficiently combat this hazard. The following are highlights of this program:

Traffic safety indoctrination training for non-prior service airmen and young officers.

Development and publication of a traffic safety manual.

A team approach at major and subordinate command levels.

Use of a traffic safety program inventory at base level to evaluate program requirements and measure program progress.

Continued emphasis on seat belts, with the goal of belts being required as a prerequisite for registration of private vehicles on Air Force bases.

Seminar 3 dealt with the problem of protection devices at explosives storage facilities which provide only a minimum degree of protection to personnel outside the work area. The delegates recommended that a new design be developed with respect to handling and processing facilities to afford a greater degree of protection for personnel and equipment. The results of the explosives tests indicated that exposures to explosives hazards should be re-evaluated to minimize the number of activities and reduce the number of personnel within the operating buildings.

Transportation of explosives was a matter of particular concern. Areas for parking of aircraft, in-transit holding and common terminology were subjects considered. Clarification and publication of more up-to-date guidance for field units is expected to provide for greater safety in this area. Of special concern was handling, storing and maintenance of CB systems. In the area of explosives safety, better definition of personnel duties was isolated as an area of concern for 1965.

Look for more emphasis on sports and recreational accidents during 1965. Over 2000 such accidents occur to Air Force personnel each year. The tab comes to $8,000 per day. More stringent safety requirements can be anticipated.

Past experience has shown that greater safety planning is essenti in military exercises, particularl on the flight line complex. Look fc guidance on such things as use c hand signals, loading and unloac ing, better communications an coordination.

Abbreviated accident reportin procedures are to be further r fined. Past field tests have show advantages for reporting organiz tions, major commands, and H USAF. Misinterpretations an ambiguities are being clarified.

Seminar 10 came up with pr posals designed to better spell ou ground and explosives trainin requirements.

MISSILE SAFETY

The USAF Missile Accident Prevention Plan for 1965 was developed by three seminar working groups and centers around three major areas:

- Hazard Analysis Program
- Supervisory Safety Training
- Composite Safety Survey.

To reduce hazards they must first be recognized. The following tools of identification are recommended:

- Job review
- Facility review
- Support review
- Hazard reporting
- Safety surveys
- Military suggestion program
- AFM 66-1 data
- T.O. 00-35D-54 reporting.

And here are the recommended actions after the hazards are identified. If not correctable, take action through established Air Force channels to:

Modify the hardware and facilities.

Change tech data and procedures.

Document the hazards.

Disseminate the information.

Insure adequate pretask briefings.

Placard and distinctly mark as appropriate.

Seminar 2 dealt with Supervisors' Safety Training. Conferees asserted that the proper method and most logical way of making missile personnel safety conscious is through the supervisor. A safety education effort aimed toward defining supervisors' responsibilities is programmed in safety magazines, films, kits, bulletins and the TIG Brief. Additional proposals include: development of Air Force regs, letters reviewing supervisory deficiencies of serious accident potential and inclusion of safety psychology in formal Air Force schools.

The third Missile Safety Seminar dealt with establishment of a con posite missile safety survey meth for like weapons systems. This co cept is based on ADC's BOMAR survey method. Each command loses the services of his safety c ficer for one week each two mont but annually has the services of safety officers for a one-week pe iod. Mishap prevention and assi ance to individual units are t objectives. Benefits include:

Standardization of missile safe programs.

First-hand information on pro lem areas and how they are bei handled.

Sharing of new ideas and e changing of safety information.

The TAC proposed revision officer classification to clarify MS and FSO responsibilities regardi air launched missiles was also di cussed. It was recommended th the Director of Aerospace Safe conduct a study on this matter.

CONCLUSION

These are some of the safety activities we can look for in 1965. With increased emphasis on cost reduction programs, accident prevention plays an ever-increasing role. Losses that are preventable cannot be tolerated. Each and eve person in the Air Force — milita and civilian — can help. ☆

MOUNTAIN WAVE

Last winter an Air Force B-52 on loan to the manufacturer was on a low altitude mission to study turbulence effects on the aircraft's structure. The aircraft literally lost its tail in clear air turbulence on the lee side of Spanish Peak in the Colorado Rockies.

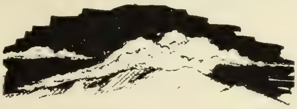
Thanks to superlative airmanship and radioed assistance from skilled aerodynamic specialists, the crew was able to safely land their specially instrumented craft. They had tangled with severe mountain wave turbulence. Other air crews have not been as fortunate. Structural damage has resulted in loss of control and aircraft destruction.

The mountain wave phenomenon occurs when wind flows across a mountain or ridge of mountains. The rule of thumb has long been to avoid flight in such areas when the wind component perpendicular to the ridge exceeds 25 knots. If such areas cannot be circumnavigated it is recommended that flight across the ridge be at least 50 per cent higher than the height of the range. This is not, of course, a guarantee of smooth, safe flight, since effects of mountain waves can extend as high as 70,000 feet.

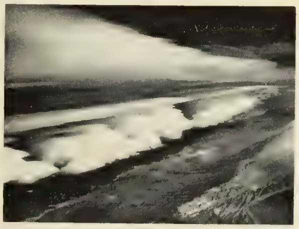
There are clues to mountain wave turbulence that should enable the alert pilot to avoid this hazard. The first and probably the best is to always obtain a preflight briefing on your route of flight from a qualified forecaster. Study of winds aloft charts should provide fairly reliable indications of the potential for mountain wave turbulence. Enroute, listening to pilot reports, checks on Channel 13 with metro stations along the way, monitoring weather reports by Flight Service Stations and observation of cloud formations for the tell-tale clouds frequently associated with mountain wave conditions should serve to keep the alert pilot clear of this hazard.

Here are the cloud formations that indicate the existence of mountain wave turbulence:

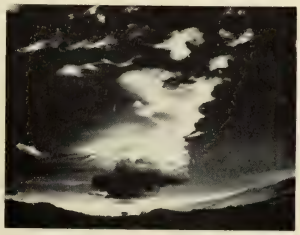
Cap clouds. These hug the tops of mountains and may flow down the leeside like a waterfall. Such cloud formations are known as foehnwall clouds and may contain downdrafts of as much as 5000 feet per minute.



A cap or foehnwall cloud, severe downdrafts.



Typical mountain wave clouds seen from above.



This lenticular is ragged, expect turbulence.

Roll clouds. As the wind spills down the side of the mountain and reaches the valley surface it shoots up again, is cooled, and moisture condenses into clouds that have a distinctive roll or rotor motion. The base of the roll cloud may be below the mountain peak and its top well above. More than one such cloud may form downwind from the mountain as the wind flows down, then up again in successive waves. Updrafts of up to 5000 feet per minute can be experienced on the upwind side of these clouds and downdrafts of the same velocity on the downwind side. Such windflows produce sharp shear areas and extreme turbulence. Pilots have reported turbulence in these areas to be more severe than that normally experienced in thunderstorms.

Lenticular clouds. These clouds, distinctively lens-shaped and frequently seen over the Sierras, form above the roll clouds and, like the roll clouds are stationary. Lenticular clouds are normally smooth. Occasionally a breakdown in the wind flow can cause turbulence. Severe turbulence is most likely to exist at the extreme altitude of the tops. If the lenticular is ragged, suspect turbulence and stay away. Allow ample clearance when flying in the vicinity of any of the mountain wave type clouds since the strong up and down drafts can carry your aircraft into the clouds and areas of greatest turbulence.

Mountain wave turbulence can occur without the presence of clouds. Checking wind speed by observing smoke and blowing dust and comparing ground speed with true airspeed and drift are warning signals for the alert pilot.

Loss of the tail of the B-52 is but one of many examples that have dramatically portrayed the hazard of the mountain wave. Years ago, during a mountain wave test program, a sailplane that was stressed to withstand 14G's was torn apart during flight through a mountain wave rotor cloud at Bishop, California. Though injured, the pilot was able to bail out successfully.

It this isn't inducement enough, remember too that turbulence of the mountain wave can mingle with the clear air turbulence of the jet stream, particularly in winter.☆

HOW SAFE?

Part I of a two-part series on determining the condition of the accident site, and the procedures for conducting a thorough investigation to determine the causes of the accident.

IT'S DONE — IT'S OVER — THE EXPLOSION HAS HAPPENED — THE FIRE IS DYING OUT!!

But somewhere inside the twisted, bent, burnt debris and rubble that was an operational silo lie some answers: the answer to what happened, the answer to why it happened, and the answer to what can be done to prevent its happening again. Those answers must be found as quickly as possible. The other missiles of that model may be in jeopardy. Some part may be defective; some procedure may be wrong; or some personnel training may be lacking.

The first thing that must be done is to conduct a silo safety evaluation. Based on experience gained from ICBM mishaps within the last year, the following is an outline of steps and precautions to be observed in conducting a silo safety evaluation prior to detailed accident investigation. While each different ICBM has its own support equipment peculiar to that weapon system, the basic missile vertical storage configuration is the same.

Major accidents have occurred with the missile and related equipment in varying stages of operation. Silo doors have been open when the big blow came, silo doors have been closed at the time of explosion, silo doors have been partially open when the missile was destroyed, and once the missile was up and locked when fire lapped around it. The end result has been the same in each case.

The silos received major damage each time. The main beams of the crib structures were twisted, bent, and warped. Wall concrete spalled onto stairways and throughout the silos in varying amounts. Fire further added to the scene of destruction by burning equipment which was not blown out.

The picture presented to arriving investigators is a bleak one and dictates that caution be the watchword. To have someone injured during the investigation is uncalled for, to say the least. Therefore, the policy is to "walk before you run."

The officer who is to be the complex commander during the investigation should get to the site as soon as possible after the explosion. We have learned that this is the first step. He should immediately establish in everyone's mind that he and he alone has assumed control and responsibility. To prevent debris disruption by the curious, as well as to keep the area clear during safeguarding operations, this procedure is a must. During these early phases, he must retain strict control until entry into the silo can be made. His vouching authority can be delegated to other accident investigation team members, but not his authority to control. To aid the new complex commander, an air policeman should be assigned to take charge of site security. He should be on duty at the site until the investigation is completed.

The initial site visit by the officer in charge is manyfold in purpose. In addition to securing the area, he should make a rough estimate of damage and determine equipment requirements. Experience indicates that if he arrives at the site within 24 hours after the explosion, he will find that fire or intense heat will still be emanating from the silo. This will, in all probability, decrease the next day and allow close silo observation. The first visit will tell the investigator the condition of the launch control area entry, the silo doors, the extent of gaseous vent damage. At this time it is important to note the location of topside debris in order to plan future equipment placement. At this time an assessment should be made as to the feasibility of allowing standby fire equipment and security personnel to move in closer to the perimeter area. Also, consideration should be given to establishing communications with the base. It is paramount that communications be effected as soon as possible. Time will be saved if this can be done by land line, at least to the security area.

Major Curtis N. Mozley, Directorate of Aerospace Safety

Subsiding of the fire will dictate the time schedule for silo safety evaluation. Normally, it has been possible to place a "purge" unit on the silo cap, blowing down into the silo, within 48 hours after the explosion. The purge unit should be placed so that the air flow is directed downward around the spiral staircase or ladders intended for future use. This downward flow of air will expedite the cooling of the silo and aid in dissipating gases from within the silo. A note of caution at this point: the purge unit trailer should remain attached to the tractor until all danger of fire flareup has passed. The support base should establish a service schedule for the purge unit as it must run continuously for many days and nights.

When an investigation is underway, a standing requirement exists for an on-site, standby ambulance as well as a fire truck. A 20-ton crane with new cable and a personnel "bucket" is mandatory. Again, the crane operator should be assigned to the accident board complex commander for the duration of the accident investigation. Continuity requires the operator to be thoroughly aware of the standard signals and what is being attempted. Also, the lowering of personnel into the silo by the "bucket" is a smoother, more confident operation, if the crane operator's capabilities are known.

Prior to entry into the silo proper, the topside must be made secure. Pictures should be taken of the cap area before debris is disturbed. All openings (air intakes, exhaust vents, the silo opening, etc.) must be cordoned off by chain, rope, or wooden barricade. If the silo doors are standing open, they should be secured so that it is impossible for them to close or fall open. This can be done by welding a shaft to the cap area or by fastening strong link chain to a suitable tie-down.

All vents should be free of debris or obstructions. High pressure gases as well as fuels and oxidizers have, in the past, continued to vent for days after the explosions have destroyed the remainder of the silo. If, as has happened, one of the silo doors has mashed some vents flat, it must be removed. Inasmuch as the weight of these doors exceeds the capability of most mobile cranes, a good way of movement is by the use of jacks and rollers. Insure that the intakes and exhausts are clear. This will, in conjunction with the operating "purge" unit, provide a path for air to circulate to and from the silo.

Remove all light weight pieces of debris from the silo opening and make sure they are tied down so they will not be moved by wind or by personnel. If all safety precautions have been taken topside, and if the heat has dropped in intensity, the initial entry can then be made into the launch control area. It is highly recommended that the most experienced personnel available make this initial entry. Two investigators and one base photographer should make the penetration. Before they enter they should review statements from those who evacuated the launch control area after the explosion/fire. These statements can provide clues as to any structural damage that may be encountered. A safety man should be positioned at the top of the entrance stairway. Entering personnel will carry a portable oxygen analyzer and take samples at least every five feet of descent. Also, an explosimeter will be carried and readings taken as the oxygen content is checked. Scott Air Paks will be worn during the initial penetration and until it has been determined that the air is safe. No pictures should be taken until after the explosimeter has been checked—an exploding flash bulb could trigger an explosion of trapped gases. If available, a strobe light should be used.

Personnel entering the launch console area may notice a smell of burnt paint, dust, and acrid odors even though the oxygen reading is normal. After the explosimeter reading indicates all is safe, pictures of the area should be taken. All charts, pieces of equipment, consoles, loose papers—in fact, everything in the room(s)

Purge unit provides downward flow of air for cooling and dissipation of gases. Immediate service of unit must be available.

should be photographed. Classified papers should not be touched; firearms, watches, etc., should not be disturbed. (A designated classified control officer from the base should accompany the team making the next entry into the launch console area. He should pick up all classified material and loose items of value having no bearing on the investigation. These should be inventoried and a copy of the inventory left with the accident site complex commander.)

Emphasis should be placed on pictures of indicating equipment such as facilities remote control panels, diesel engine panels, tanking panels, etc. Be sure to photograph any electric clocks to aid in timing sequence of events.

During the initial launch control area penetration, analysis can be made to determine feasibility of subsequent connection of electrical power, communications, and water facilities into the launch console room area.

This initial penetration can be done with flashlight illumination, but each base has 9-volt Porta Lights available. (These should be checked periodically, for experience shows they are a must for silo penetration after a major accident.)

Once the launch control area has been judged safe for further entries, the pentration of the silo proper can be programmed. More people and equipment will be required. Again, and of utmost importance, an experienced penetration team leader is required. Other team members should include a member of the accident investigation team, the local missile safety officer, and the base photographer

The crane should be exercised by swinging the personnel bucket over into the "hole" and back. This will determine boom position for future use. Strong nylon rope, a portable fire extinguisher, two safety belts, two Scott Air Paks, and a hand-held bull horn should be prepositioned in the personnel bucket. Each man should have a whistle and understand signals to topside. A topside (cap) safety observer should be designated to direct the crane, if required, and to monitor the penetrating team. He should confirm hand signals with the crane operator, as well as be prepared to go into the silo in the personnel bucket for rescue purposes.

Assuming the silo can be entered through the launch control area, a safety observer should accompany the team to the first level entered from the silo tunnel. He will position himself so as to observe the team as downward progress is made.

With the exception of the photographer, each team member should carry a 9-volt Porta Light with new battery and wear a safety belt with loop. All penetrating personnel should wear Scott Air Paks and the team leader should carry a calibrated oxygen analyzer. He should also carry a miniature portable tape recorder and record his observations as penetration is made. The unit missile safety officer should follow the team leader and carry the explosimeter as well as a 100-foot coil of strong nylon rope. The other accident investigation team member should be responsible for the photographer and determining pictures to be taken. He can also be the time monitor. (The endurance of the air-breathing apparatus dictates that, in the event of contaminated air, egress from the silo depths must be within a specified time period.) In addition, this team member should carry a small, hand fire extinguisher since small fires have smoldered within the silo for days.

The base photographer should be suitably dressed in one-piece coveralls and have enough portable equipment to take 100 pictures on the initial silo penetration.

Prior to opening the blast doors, the team leader will check the tunnel area for oxygen content. Care should be taken as the doors are opened because hanging debris or concrete could be disturbed. Grating or flooring should be checked very carefully as progress is made.

The penetration should not be hurried and pictures should be taken as the team works its way from level to level. All previous accidents have showered spalled concrete throughout the silo and especially on the staircase. With care, all stairways were usable, but footing on spalled concrete is insecure at best. Movement on the stairways, initially, should be restricted to one man at a time. It is conceivable that loose concrete cascading downward could cause either a secondary explosion or further silo damage.

Oxygen and explosimeter readings must be taken at each level and downward progress should be predicated on the readings obtained at higher levels. Hissing noises, splashing sounds, and eerie burps will probably be heard. The escaping high-pressure gases and stored propellant create noises fit for "Outer Limits." The sight of liquid oxygen spurting from a fractured line connection or a loose vibrating gaseous nitrogen line add emphasis to the watchword—CAUTION.

These are considerations as the silo safety evaluation is made. If more time is required for LOX boiloff or trapped pressures to vent, confine further investigative efforts to areas that are well clear of the hazard area Monitor the venting gases on a daily basis until all is clear or adjudged to be safe, but don't take needless chances.

The answer must be found, true, but safety must always be paramount in an investigation of this kind.

(The second part of this two-part series will appear in the February issue.) ☆

Rex Riley's CROSS COUNTRY NOTES

SOME COMMENTS ON EMERGENCIES: Every once in a while Rex finds himself sitting in on a bull session on emergencies. There are several schools of thought that can be pretty well categorized:

- Do everything exactly by the book—if you bend the bird at least it's not your fault. Exponents of this course of action contend it is better to do major damage, and do it by the book, than to deviate and possibly do less damage, but run the risk of criticism for deviations.
- Know the systems, and react accordingly, using the "book" solution only as a guide.
- Do as you like, using as your authority the Dash One paragraph that contains the statement: The manual provides the best possible operating instructions under most circumstances, but it is not a substitute for sound judgment.

It would appear that the above three schools of thought would be enough to cover most any course of action. Not so. Shocking as it may seem, Rex was recently told by a pilot who did not know the engine failure emergency procedure: "It's not important anyway—how often does anyone actually have an engine failure in this airplane?"

Well now, this is the attitude that really drives me to get out the soap box. How would you like to be riding in the back seat with a guy up front who doesn't know his emergencies "because they don't occur often?" You wouldn't accept this philosophy on the part of the doctor who might be called upon to operate on you. Still, how often do you need an operation? Your life can be at stake in either case.

It all leads back to one of Rex's favorite subjects—professionalism. Rex likes to think that his fellow Air Force Pilots are real professionals who take pride in their work. Most are. We don't hear much about them because they go along, day after day, doing the job. They are the ones who know their aircraft systems, know their emergency procedures and know how to use common sense. They are the ones who convert a routine inflight emergency into a routine landing.

They're the ones I want up front. How about you?

CHECKLISTS, HORNS AND REMINDERS — By the time this gets into your hands, the story may have changed but as of now, meaning right now with ol' Rex sittin' here with the message in his hands, there have been six gear up landings so far (1964) in which the pilots were at fault. That means six scratched up—or worse—airplanes and more than six mighty embarrassed pilots. The aircraft involved were trainers, fighters and transports. One resulted in a major accident, three were minors and two were incidents.

Now one way of putting a stop to this kind of nonsense would be to weld all the gears in the down position. This not being practical, we had better look to better methods. For one thing, commanders and safety officers can bring this problem to the attention of all pilots—let 'em know that this method of landing is 180 out of phase with the book and all we've been teaching all these years.

You might have a little talk with the tower people. If they don't know, they should be made well aware of what can happen when a pilot is distracted by chatter from the tower while he's in the midst of a before landing check.

Also, controllers could put a mite more emphasis in checking with the pilot for gear down. Rex suspects that biggest part of the time this is a routine sort of thing, like a friend of mine who scratches his nose every time he rolls out on final. Nervous habit, I guess.

While we're on the subject, it might be a good idea to remind pilots that FAA towers do not give oral gear checks in their landing instructions.

'Nother thing sorta griped Rex when he heard about it. Seems a pilot could not be given go-around advice because mobile was out of service returning from base operations after exchanging duty officers. Wonder if they drive the mobile in for lunch too? Surely there are some other vehicles around to drive the duty officers to and from. Anyway, who was handling the landing in this case? Was the tower out of business too?

Anyway you slice it, gear up landings—when the gear works okay—are inexcusable. We have checklists, horns, reminder by the controller and lights in the cockpits. What else do we need to finally put an end to this expensive, highly unprofessional and dangerous practice?

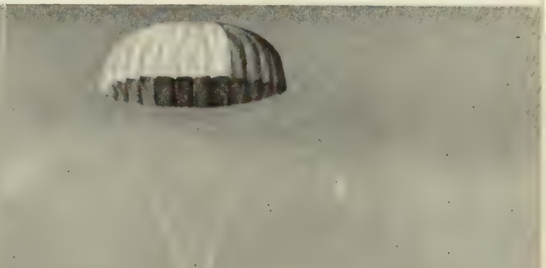
Rex Riley

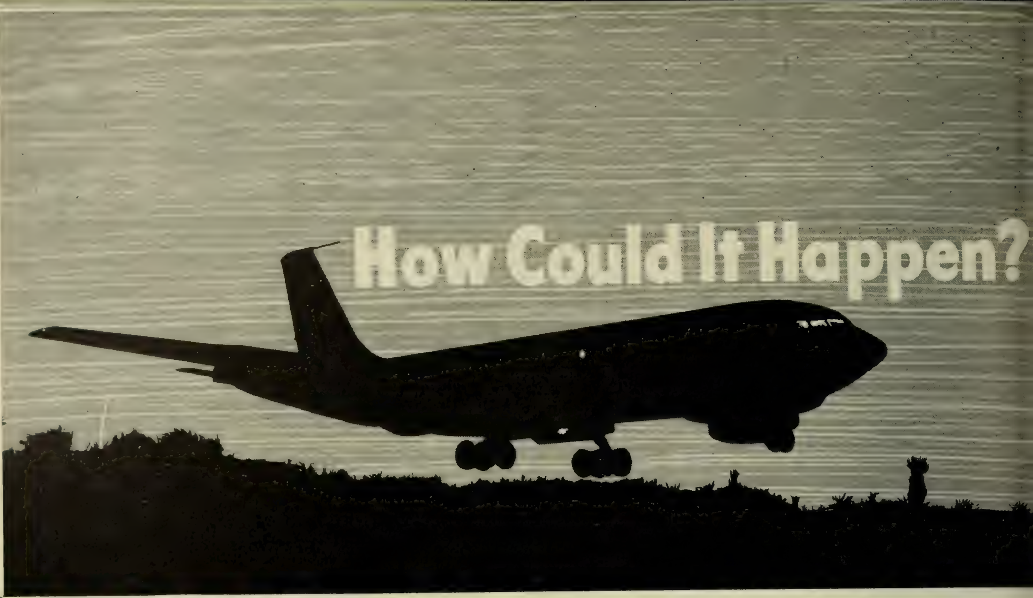
0-0 ZERO ZERO EJECTIO

As shown by these photos, a zero altitude, zero speed escape system has been developed. These pictures were taken at San Diego, California, during demonstrations put on by the manufacturer, Weber Aircraft Corporation, for members of the USAF Personal Equipment Advisory Group, Space and Flight Equipment Group and other interested safety personnel. These pictures show one of four ejection seats fired during the demonstration. In this particular sequence, involving an F-102 seat, the rocket seat firing, seat separation, and chute deployment are shown. The seat and mannequin were thrust to a height of approximately 350 feet. After a two-second delay a drogue gun fired, deploying the pilot chute which forcefully withdrew the main chute canopy from the pack. Standard Air Force chutes were used.

The other three firings included an F-101, F-105 (visible in the first picture) and F-106 ejection seat. All were equally successful. The F-106 shot was an official test under existing AF contract. (Weber was awarded the contract to replace the rotational supersonic seat in the F-106 with a conventional upward type seat.) This was the sixteenth consecutive successful static test with this system. The other three shots were conducted to demonstrate the compatibility of the drogue gun deployed parachute concept with other USAF ejection seats.

For demonstration purposes, instrumented dummies were used and a chute for recovery of the seat. The manufacturer states that the G forces imposed are well within human tolerances.





How Could It Happen?

One of the thickest accident files in the safety directorate relates the details of a minor aircraft accident that surely never should have happened. When all the work that has been done to prevent just such an accident as this is considered, the fact that it *did* happen is almost beyond belief. It almost seems this one was predestined, *despite* the efforts of a sizeable number of safety conscious people. We ask you to read on as the pertinent facts are reported, then, if anyone has a suggestion on measures that can be taken to prevent another like accident—short of not flying—let us know; write, care of the Editor.

Before departure from their home station the crew was briefed on the mission in accordance with command directives. This briefing, for the pilot crewmembers, was held in the terminal coffee shop. The navigator and airman crewmembers had attended a formal briefing in the squadron previously. Available for briefing purposes was a flight crew information brochure that warned, among other things, "never make a left hand pattern for _ L or __ R." This guide also identified terrain and other hazards near the base. The three pilots and the navigator went over this brochure a day prior to the mission.

En route, prior to descent, the pilots and the navigator briefed on the approach. The Enroute Supplement, which stipulates right traffic to runway __ and warns of terrain obstacles and lack of lights, was used in this briefing.

Nearing destination an en route descent was requested and received. Control was handed off from Center to Approach. The pilot reports that the radar vector they were given brought them through a saddleback between two peaks and that red lights on the peaks were clearly visible. Because of the apparent height of the peaks the pilot asked Approach as to their height and learned they were more than 1000 feet below his assigned flight level. At about this time Approach asked that the pilot report field in sight. Due to the mountains the field wasn't spotted until the aircraft was in the saddleback. When the field was spotted a turn was made for *left* downwind and the flight path purposely angled to the right due to the closeness of the downwind. At this time, according to the pilot, a gradual descent was also started. When the pilot reported field in sight, Approach cleared the aircraft to tower. Turning base a gear check was requested and made. Final was overshot and turn continued to angle back to line up on final at, according to the pilot's estimate, 30 degrees. At about this time the tower cautioned to be careful of high terrain. Shortly after this the aircraft struck the ground approximately four miles from the runway and less than 400 feet above runway elevation. To better let you re-live the drama, let's tune in on the tape recordings of the communications between Approach, Tower and the Aircraft. (Frequencies, altitudes and aircraft numbers changed or deleted.)

APC: Flight 123, advise when you have Podunk runways in sight.

APC: Flight 123, Podunk runways now 11 o'clock, four miles. Advise when you have them in sight.

APC: Flight 123, do you copy?

123: Roger. I copy—uh—we're debating whether we got 'em in sight now or not.

APC: Very good.

123: Uh Rog-123. We have 'em in sight now.

APC: Roger. Flight 123 cleared for visual approach Runway — Right. Stand by this frequency momentarily.

123: 123

APC: Okay, he's on left base Podunk-uh-two miles of your - uh - left base-two miles left base now.

TWR: Okay. Let me take a look here.

APC: It's a little hard to see him tonight, eh?

TWR: Yeah we can't—we can't see him yet.

APC: You fellows—

TWR: Will tell you as soon as we see him.

APC: _____ feet, and he's just a mile off the end of your runway now—NE of your runway.

TWR: Okay (pause) okay, got him now. Landing assured . . .

APC: Real fine. Here we go. Flight 123, contact Podunk Tower on 333.3, that's 333.3 immediately.

123: Roger, do you have a VHF please?

APC: Yes sir, 122.2.

123: Roger. Thank you very much.

APC: Roger you bet.

123: Podunk, Flight 123.

TWR: 123, Podunk Tower.

123: Roger. We've got the field in sight, in the process of making some kind of an approach here.

TWR: Roger. Landing runway ___. Have you in sight, report gear down. Wind (given as fifty degrees off runway heading) at six, cleared to land.

123: Uh, Roger, gear is down and locked.

TWR: Roger.

TWR: 123, Podunk Tower.

123: 123, go.

TWR: Roger. Use caution high unlit terrain north northwest of Podunk. Cleared to land.

TWR: 123, I do not have you in sight now. Show landing lights, please.

TWR: 123, Podunk Tower. Do you have the runway in sight?

TWR: Flight 123, Podunk Tower, Do you read?

TWR: Flight 123, Podunk Tower, Do you read:

TWR: Flight 123, Podunk Tower on guard. Do you read?

TWR: Flight 123, Podunk Tower. If you read, blink your lights, please.

TWR: Flight 123, Podunk Tower on guard. If you read you can make a right turn now, get on a right downwind landing ___, runway ___, winds calm, cleared to land.

TWR: Flight 123, Podunk Tower on VHF, do you read?

123: Ah, roger. I am reading you now, uh, we had hit some terrain out there and we are getting uh—O.K.—we're getting a safe indication on the gear now and we will be coming in—around for another approach.

TWR: Roger 123, I understand. Enter on a right downwind for runway _____.

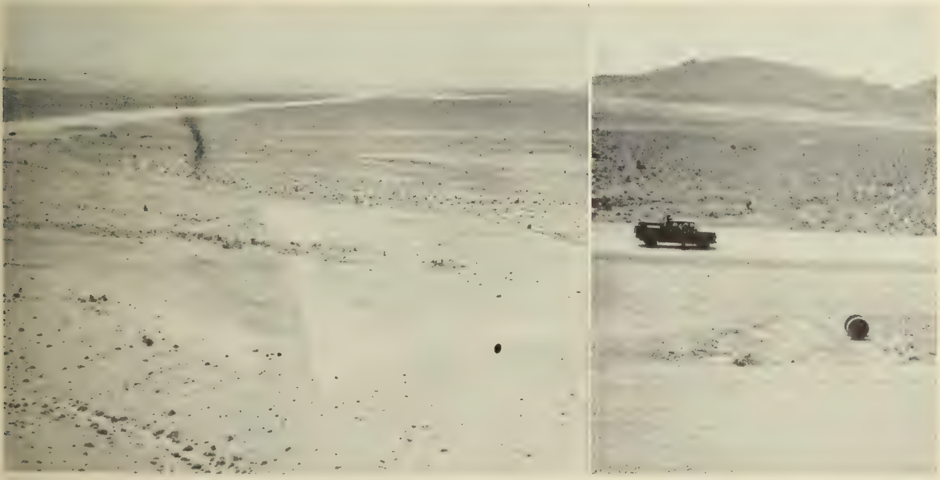
Investigation and analysis disclosed that:

Weather was clear and not a factor. All crewmembers were in good health. Physical exams were current and no waivers were or should have been in effect. Crew rest was not a factor. The pilot and copilot used oxygen for 15 minutes during the last hour prior to landing. All personal equipment used functioned properly.

There was no evidence or indication that maintenance error, component malfunction or materiel deficiency was a contributing factor in the accident.

Training records showed that all crewmembers were current and qualified.

Remembering the briefings, the brochure, the Enroute Supplement and the transmissions concerning the terrain, we come back to the original question: HOW COULD IT HAPPEN? ☆



The strange scrape marks across barren ground and a gully were made by the tires on an Air Force aircraft during a VFR approach on a clear night. More evidence in the picture on the right, a pair of main gear wheels and tires knocked off during the desert touch and go.

When it's time to leave a sick aircraft—Go! Don't wait 'til those last . . .

Deadly Seconds

"I'M BAILING OUT!"

Later it was found that the pilot went in with the aircraft. Apparently he made no attempt to get out.

The above does not describe a frequent occurrence, but it happens often enough to cause serious concern. Why do pilots fail to get out of doomed aircraft when they know they are going to crash? Seldom can the reason be stated with surety. Only guesses can be made—educated guesses, perhaps, but they are still guesses. Did he delay too long? Did he think he could get the aircraft under control in time? Did the ejection mechanism fail?

Before jets and ejection devices, pilots were expected to try to save the aircraft. Today things are different; the man in the cockpit is not asked to risk his life by trying to put a sick jet fighter on the ground. There is no stigma to getting out while the getting is good. With the increased reliance on thrust in jets, their critical glide angle and loss of power boosted controls when the engine fails, it just makes sense to save the crew first, the aircraft only if it's virtually a sure thing. The number of ejections we have is evidence that Air Force pilots have been well indoctrinated with this point of view.

But there is another facet of this problem. It has been covered before but in light of recent experience deserves reiteration. This is the case of the pilot who recognizes that he is in trouble and apparently intends to get out while he can but who delays too long. An example is provided by a student who announced that he was in a spin and that he was bailing out. Immediately after this transmission the aircraft was observed by another pilot who estimated its altitude as 10,000 feet. About eight seconds later (11 seconds prior to the crash), the student transmitted that he was in an inverted spin. The mike remained keyed until a second or two prior to impact; apparently there was no attempt to eject.

Between the pilot's last call and impact Mobile directed him to bail out. In fact, this order was repeated several times but with the mike keyed the pilot would not have heard these transmissions.

Apparently this accident was caused by spatial disorientation on the part of the pilot. Witnesses stated they were able to see the aircraft lights and follow them almost to the point of impact. They did not think that the plane was in a spin. That the aircraft probably was not spinning was indicated by the velocity with which it hit the ground—estimated as being more than 400 knots.

The tragedy here is that this pilot had plenty of time to eject safely. If he had left the aircraft immediately after his first call he would have had more than enough time. If he had got out right after his second call he probably would have made it, although it would have been marginal. To have delayed past that point surely would have been fatal.

Reconstructing, with some simple arithmetic, we find that assuming 400 knots speed he would have been traveling at about 675 feet per second. We don't know his exact rate of descent because we don't know for sure the attitude of the aircraft. By fudging a little, we will say that he was descending at 675 ft./sec. This would place him at 12,825 feet 19 seconds prior to impact. When he made his second call eight seconds later he would have been at 7,425 feet, more than 2500 feet below Dash-One recommended minimum altitude for ejection from a T-33 out of control.

The possibility that he could have safely ejected at about 7500 feet does not negate the advice in the handbook. The fact that this pilot probably was spatially disoriented very likely influenced his decision on ejection. He thought he was in a spin and probably didn't realize how fast he was descending. This indicates that he was relying on outside references and not on his instruments. Whether the aircraft was uncontrollable or not is beside the point. He THOUGHT the aircraft was in an inverted spin. To him it was out of control. He should have punched out not later than 10,000 feet.

We realize that this is Monday morning quarterbacking. But if this reinforces all of the other materia on this subject and in any way helps prevent such fatal accidents as this one, then Monday morning or any other kind of quarterbacking, is worthwhile. ☆

Guns Don't Kill ...People Do

The fact that Air Force personnel continue to kill each other and themselves in accidental shootings indicates there is a need for education in the proper respect, care and handling of firearms. You will note that the term "respect" is listed before "care and handling," for without respect even a knowledgeable person can wind up on the wrong end of a discharged firearm.

Guns don't kill people. People kill people. And they do it with all manner and means of implements. Killing others and themselves by the use of an automobile has reached a magnitude whereby the ground safety people are able to predict (with a minimum of variance) just what time of day the next auto accident will occur, what the age and rank of the driver will be and how far from the base it will happen. It is not so easy to predict just who will practice the "quick draw" and end up a cripple for life; or who will become excited during the opening day of pheasant season and blow his hunting partner in two, or who will trip while carrying a loaded rifle with the safety off, shoot himself and bleed to death just a few yards from a highway. These accidents don't just happen. They are caused. The tragic part is that by being caused, they can be prevented, but are not.

An accident occurred when an Air Policeman determined (erroneously) that because of a broken disconnector spring in his .30 cal. carbine, it would not fire because the firing pin would not function. He had tried to pull the trigger several times (with the weapon unloaded) and it would not "click." To impress his fellow Air Policemen, he inserted a live round into the carbine, placed the muzzle under his chin and squeezed the trigger. Surgery saved his life, but necessitated the removal of an eye and the left half of his brain.

Several airmen were on a hunting trip and were staying in a remote cabin. One of the party decided to shoot through the doorway at a barrel. Others followed, even though the light was not good. Sometime during a lull in the shooting, one man went outside. He was shot through the head when his companions resumed their "target practice."

These happenings are not just gory stories to emphasize a point. They are typical of the events associated with the 36 deaths and 510 accidents which occurred during the last 32 months involving firearms. All resulted from unthinking acts of individuals wearing the same uniform as you.

How can you tell who this individual is? You can't. But watch out for the guy who clears his automatic by first working the slide (ejecting one round) then takes the magazine out and says it's safe. Look for the guy who has a pistol hidden in his locker in the barracks and shows everyone how smart he is not having to store it with the Provost Marshal. And notice the guy on the firing range who gets a jam or miss fire, and drags the muzzle right through your head while trying to open the receiver. He could be the one who "just forgets." I've seen a top three grader, who was pulling security duty, try to swing out the cylinder of a .38 special service revolver by first pulling the hammer to the full cocked position. I dont know if he got the cylinder open, I didn't stick around.

If accidents involving firearms are not predictable, then what can be done toward their elimination? To begin with, the general principles of gun safety should be drilled into every person in the Air Force. Commanders should insure that personal firearms are stored securely, yet available to the owner for off-duty use. Owners should be required to demonstrate the proper care and handling of firearms. Air Police should receive a continuing course of instruction (as evidenced by their frequent involvement in shooting accidents) because of the greater exposure and use. The list could go on and on; each commander should tailor his requirements to the situation. Obviously, the personnel of the USAF Marksmanship Team don't require as much supervision as a new group of AB's.

Gunshot wounds can be very painful and permanent. Often there is no second chance. Movie and TV actors get up and walk away when the shooting's finished. In real life, they often lay there until the coroner arrives.

Don't kill your friends — or yourself!

PRINCIPLES OF GUN SAFETY

- Treat every gun as if it were loaded.
- Always point the muzzle in a safe direction.
- Be sure of your target.
- Keep your finger out of the trigger guard until ready to fire!
- Practice self control.
- Open the action and unload any gun not in use.
- Store guns in a safe place.
- Be sure the gun and ammunition are in good condition.
- Sight-in guns before using.
- Learn to be a good shot.
- Insist that your companions observe these same rules.

A Winter Pattern

The early Florida sun began to make its presence known through the back of Joe Collins' jacket as he walked across the ramp to where AF 57246 was parked. He looked at Gene Murphy, walking beside him, and said, "That sun feels good at this hour. Bet we'll really appreciate it by the time we get back."

"Rog," Murph replied, when he had finished his yawn.

"What's the matter—not much sleep last night?"

"Naw. Fran had planned these two tables of bridge. Couldn't change at that late date. The last couple didn't leave until three. Everybody else gets Saturday off, you know."

"I could probably have got somebody else."

"No sweat. I need the time. Haven't had a good cross-country in a long time. K.C. used to be a great town. I'll try and catch a few winks on the way."

Joe made the next comment to himself. "Hope the autopilot works." He hadn't turned in very early himself. Today was his anniversary and, since he wouldn't be home, they'd gone out for dinner and a show. Years ago, when he'd had a cockpit job, he would be gone half the time and his wife understood. But now she didn't understand, when he hadn't flown at all for 42 days, why he had to be gone on their anniversary.

At the plane he said to Murph, "You want to make the walk-around—I'll do the inside."

"Rog." Murphy threw his bag in the door and started around the tail. Joe tossed his bag in, climbed the short steps and made his way up the sloping aisle of the C-47. All the seats had been pulled out along the left side and cargo was lashed in place. He pulled on a couple of the tiedowns as he went forward. He hunted around until he located the 781, noted that the bird was on a red diagonal and checked airframe and engine time. The right engine had 1426 hours, the left 154. He liked them at 600 hours—then they were broken in and should have a lot of good time left. He checked the writeups. There were two successive writeups, "Oil leak Nr 2." Corrective action was shown after both. In each cause it concluded with "Grd checks OK." Joe shrugged and signed the form. He picked up the checklist and began leafing through it.

"Ready?" Murphy had come up behind him.

"Yeah, here, you call the checklist and we'll get fired up. Alert show up?"

"Rog."

Joe worked his way into the left seat. It was at times like this that he would momentarily vow to start the 5BX program. There wasn't much clearance between his belly and the wheel.

Joe and Murph both did some fumbling getting the machinery running. Like Murph said, "Every one's configured different." Neither attributed their not having flown for over a month to the reason for their unfamiliarity.

Murph copied the first half of the clearance, then the second half after he made the partial readback and explained, "You faded, tower."

"Air Force 57246, your right engine is smoking pretty bad," tower reported.

"Rog," Joe said. He looked at Murph. "Probably loaded up."

Murph nodded.

Finally, between the two of them, the checklist and the reliability built into the Douglas Racer they were airborne and slowly grinding toward the north and niner thousand.

"Cargo must be pretty heavy," Murph surmised when, fifteen minutes after takeoff they climbed through 3500.

"Yeah," Joe agreed. He looked at the rate of climb which now held steady at just under 200 feet per minute. For the first time his scan began to take in the engine instruments. "Hey," He said, pointing at the cylinder head gages, "look at those low cylinder head temps: 'ja ever go to trail."

"Sure didn't," Murph replied, surprised, and turned the controls below the copilot's window to trail. This helped, and when Joe pushed the throttles forward to re-establish climb manifold the rate of climb increased to 500 feet.

That's the kind of trip it was going to be. The lieutenant who had run out at the last minute to catch a ride had been watching from behind the seats. He shook his head, went back, sat down, checked the safety belt, said, "I hope it stays VFR" and fingered his rosary.

The crew discovered the oil leak north of Muscle Shoals. They discovered it when the lieutenant came up and said he'd been watching that oil leak on Number 2 and it was definitely getting worse.

Joe woke Murph and sent him back to check. Murph said the lieutenant was right, it was worse. Joe noted that the oil pressure was a bit high on Nr 2. He pulled the throttle back part way and pushed the mixture forward.

"Better land at Memphis and get it checked," he said.

"I'd sure like to make K.C. Maybe we could just keep an eye on it," Murph suggested.

Joe went back. Black oil was seeping out through the nacelle, spreading out along the flap and rippling in the slipstream. When he came back he said, "We'll land at Memphis — got that front to go through to K.C. Call Center and

"Sure a helluva change from Florida," Murph commented, adding three-fourths throttle to plow through snow on the ramp.

cancel."

Late that afternoon, standing on the ramp, Murph said, "Hard to believe how much colder it is in Memphis in January. Coffee?"

Joe checked to make sure the zipper was all the way up on his summer flight jacket. "Might as well," he said.

They finally got off. Actually, maintenance hadn't done so much work; it was just that it was Saturday and they were shorthanded. When they did get around to 57246 they tightened some rocker box covers, checked the oil lines, washed Nr 2 and made a runup. Seemed O.K.

It was dusk when the intermittent flashes of the rotating beacon marked their climbout across the Mississippi. They had the heater up all the way, but it was still cold in the cockpit. Wisps of clouds began to drift across the wings, then they were into the front. Murphy was in the left seat and he flew almost entirely by reference to his attitude indicator. He tried to approximate within 500 feet of assigned altitude as the Goon wallowed and pitched. Joe frequently used his flashlight to observe the snowflakes that swept against the windshield then exploded into nothing. He'd be glad to get there. Whoof! The bottom dropped out, then the old Goon cracked as descent stopped abruptly. Joe took a hitch in his seat belt and tried to lick some of the dryness out of his mouth.

They took turns fighting through the front. The turbulence was supposed to ease up over Flippin. They were making 90 knots ground speed. Neither noted much improvement when the needle finally swung.

"One good thing about its being so cold," Joe commented during a brief lull in the turbulence, "We shouldn't pick up any ice."

At Springfield they began to be in and out of clouds. Center gave them a descent at Holden intersection. They were down to two thousand at Blue Springs. Thanks to radar vectors they got lined up for final at Fairfax. They frowned at each other, then both leaned forward to peer through the windshield when tower advised, "There is a dyke at the end of the runway, the runway has patches of snow and ice and snow has been piled on the sides of the runway."

They made it; Murph flying and Joe keeping up a running advisory. "Sure a helluva change from Florida," Murph commented, adding three-fourths throttle to plow through snow on the ramp.

Just before shutdown Joe remembered. He asked the tower, 'What is the anticipated low temp for tonight?"

"Minus four."

"Gad!" Murph said.

"Murph," Joe directed, "See if you can find a Dash One someplace. We're going to have to dilute this dog." The Dash One wasn't readily available so they settled on three minutes. Neither thought to exercise the props.

The high point of the day was just before 11 p.m. They had obtained a room at the Muehlbach and Joe was in a hot shower when Murph came in with a bottle and offered, "How about a shot of rye?" Joe didn't care for rye, usually. This tasted extra good!

They were at the field at eight o'clock, shivering through the preflight. Each wore pajamas, flying suit, summer flight jacket and gloves without the liners. A 15-knot wind was blowing and theirs was one of the shortest preflights on record. They took a quick look in the Nr 2 wheel well. Quite a bit of oil, but Murph said, "Looks like it'll last 'til we get back to Florida. Besides, it's only a short hop to Lincoln."

They climbed in, kicking the snow from their oxfords. Part of the cargo had been unloaded. The remainder had to be delivered to Lincoln, Nebraska, not later than noon.

The wind was gusting to 28 knots at Lincoln, the temperature seven. This, Joe and Murph agreed when they and a gust made it through the door of base ops at the same time, was the coldest, most miserable weather they had ever seen. And the sheepskin clad locals who had watched their sprint across the ramp hadn't done anything for their morale either.

Never had either filed faster. They had the paperwork ready, watched from behind a frosted window, and dashed out the door as soon as they saw the truck pull away from their bird.

"Ya got an oil leak on Nr 2," an alert crewman reported, as they clambered aboard.

"Yeah, we know," Joe said. They weren't about to stay.

"One good thing," Joe said, as Murph taxied out, "this cold and this much wind—no snow should stick to the wings or control surfaces."

The Goon and the center of the cold front renewed acquaintance over Memphis. Here, at the worst possible moment for the tw shivering pilots whose main concern was to head southeast an hope, they lost Nr 2. It had bee warning people for the last 3 hours. No one had really taken the warnings seriously. Clearing ou the sludge with the dilution a

Fairfax had really increased its appetite for oil. Recognition came gradually. Old 57246 began to want to turn to the right. Joe and Murph also noticed a strange difference in the turbulence. Oil temp on Nr 2 was above the red line. Pressure was low. Reducing power on Nr 2 cut down on the vibrations. Joe watched the Nr 2 nacelle as he worked the throttle back and forth. Man, it was really rough.

He declared an emergency and asked for Memphis weather. Four hundred and one. Intermittently 100 and one-fourth in heavy snow showers.

"Wish we'd checked it at Lincoln — probably should've added oil," Joe said.

They got radar to guide them toward the field. Joe kept reducing power. Finally, when we saw smoke around the cowling, he said, "Got to feather, Murph. No power left and I'm afraid we'll get a fire if we try to keep it running."

"A 15-knot wind was blowing and theirs was one of the shortest preflights on record."

Joe pulled the throttle back and cut the mixture. The plane swerved right and Murph, in a panic reaction, reached up and punched *Nr 1*. Joe saw what happened — screamed "NO!" too late — knocked Murph's hand away and pulled out on the button. There was a sickening drop in sound, speed and altitude, then a high pitched whine as Nr 1 came out of feather and over sped. The airload on the prop brought it back within limits before either pilot could take any action. Joe pushed RPM and Nr 1 throttle up to max power. They had lost 1500 feet. He reached up and pushed the feathering button for Nr 2 and RPM dropped to 1600 and stopped. "It won't feather," Murph yelled. "Radar, we've lost Nr 2. It won't feather all the way. Request you expedite—close in pattern for the nearest suitable field."

"Roger Air Force 57246. Turn right zero one zero, pattern correction. Maintain two thousand."

"We're one thousand four hundred. Unable to climb."

"Roger. Understand. Turn farther right zero two zero."

Another vibration, different yet, shook the Goon and Joe pushed the yoke forward. "You're stalling it," he cried.

"No I'm not. Look at the airspeed. One hundred ten knots."

Joe wiped his side window, looked out, then hit the deicer boot control. "We're icing up down here," he yelled.

The airspeed went to one twenty, the altitude to 1100. The stall buffet ceased. Joe picked up the mike and said, "Better hurry with that GCA. We're icing up. Eleven hundred now." He pushed hard against the full forward throttle. He looked out at Nr 2 prop and pushed in Nr 2 feathering button.

"Got a letdown plate?" Murph asked.

"No time. Fly their vectors." He picked up the mike again. "Radar, we won't be able to climb out for a go-around on one engine with this load of ice. Gotta make it first time."

"Roger, understand. Now turn right to zero two five."

"Rog, what's the current weather?"

"Stand by."

The altimeter read eight hundred. Murph eased forward to eliminate the slight buffet. Seven hundred.

"GCA, we're losing altitude out here. Six fifty. Just give us a straight in to the closest runway."

"You get the gear," Murph yelled across the cockpit.

"When I see the runway," Joe replied. "Hang onto every inch of altitude you can."

"Can't see," Murph called. He was peering into the windshield. "Iced over."

"Fly instruments," Joe yelled, "I'll watch for you." He slammed his side window open and tried to see out. He started to say something into the mike then dropped it.

This turbulence was different. It started way out on the right side and the plane shuddered in its violence. It was caused by the right wing striking the tops of a row of trees. The nose pitched down and the plane swung viciously to the right, whipped around as though in the hand of a giant.

Realization came in that fraction of time before oblivion. Murph stood braced on his left foot, holding the controls full back and left. Joe thought of cutting the switches, but there was not time for muscular reaction. The mouth piece of the microphone swung forward against the panel and the plastic shattered when the nose crumpled against a tree.

"Air Force 57246, Navy Memphis Radar, over."

"Air Force 57246, Navy Memphis Radar, over."

The GCA operator continued to look at the spot on his scope where the target blip had disappeared. The steady hum of his equipment was the only sound.

His right hand reached out and picked the red phone off its cradle. ☆

Major T. J. Slaybaugh

MISSILANEA

THIS SIDE UP.—The "fits and convulsions" experienced when water sneaks down your wind pipe is not confined to people. A similar reaction occurs to mechanical equipment if normal precautions are not practiced. The compressor assembly which pressurizes the freon in the chiller assembly of the Minuteman G & C liquid cooling system is a good example.

The compressor assembly is a factory sealed unit using a special refrigerant type of lubricating oil. The lower portion of the unit serves as a crankcase for the oil while the upper portion serves as a chamber into which the freon return line from the evaporator is dumped. The upper chamber provides a reservoir of freon gas for the piston-type compressor. The freon is sucked from the upper chamber into the piston compressor through two upright "snorkel" tubes.

Everything works well as long as the equipment is level; but, extreme tilting of the compressor assembly or the complete chiller assembly can result in the oil spilling into the piston compressor via the two tubes. The presence of liquid oil in the compressor's gas lines produces a "hydraulicking" action on the compressor discharge valve assembly that contributes to compressor failures.

The initial packaging of compressor assemblies and chiller assemblies from the manufacturer prominently notes "This Side Up." The apparent ruggedness of the compressor assembly tends to defy cautious handling and it is fairly easy, whether marked or not, to tilt excessively in handling; however, the penalty for not maintaining the compressor upright is a reduction in Minuteman reliability. Tipping of the compressor about 40 degrees from its normal position or jarring it to cause sloshing of the oil greatly increases the probability for subsequent "hydraulicking."

In the above illustration, the compressor assembly was the object of the story "This Side Up"; but it is equally applicable to other items of equipment which require special handling.

Minuteman Service News
Boeing Aero-Space Division

OUT OF THE LOOKING GLASS

TV MONITORING OF MISSILE COUNTDOWN—The countdown had been initiated for a LOX only exercise and, although everything appeared normal on the Launch Control Console, no indications of LOX flow could be seen on the TV receiver monitoring the Stage II LOX probe. A vague feeling of uncertainty began to grip some of the observers. The Missile Combat Crew Commander (MCCC) turned to the Site Commander seated behind him, but having already noted the problem, he was hastily departing the control center with the comment thrown over his shoulder to continue the count.

The countdown, amid much silence, was continued for a few moments until the spell was broken by the Site Commander's voice coming over the communications network, advising the MCCC that LOX was flowing into Stage II.

It was found that the Stage II TV camera was focused on the wrong missile; but, of equal interest is how the Site Commander *knew* LOX was flowing to Stage II if he didn't in fact observe it from within the silo or from the tunnel entrance. And, if this were true, how did he get there during this hazardous activity—and *who* accompanied him?

HIGH WINDS — An early Re-entry Vehicle (R/V) mating had been tentatively scheduled for a distant missile site, with the realization that it might have to be cancelled because of forecast high winds A check with the duty forecaster prior to departure of the R/V mating team revealed that the forecast had not changed and that the winds would probably reach 35 to 40 mph before the scheduled R/V mating time and hold until after dark. Nevertheless, the Maintenance Control Officer elected to dispatch the mating team, hoping the forecast would be wrong. Upon arriving at the missile site, the NCOIC found the winds were high, and called the Missile Squadron Job Control for guidance.

The Base Weather Forecaster remained firm in his forecast; therefore, a call was made to a weathe bureau forecaster located more than 50 miles farthe from the site than the base. The forecast for the area i which he was located called for winds within the saf range for R/V mating. This information was the used in directing the R/V mating team to go ahead a scheduled. Fortunately, at this time, the Commande became aware of the situation and placed a hold o the operation until an accurate on-the-spot chec could be made, using portable wind measurin equipment. The check revealed that the wind exceeded the safe limits, whereupon the Commande directed postponement of the mating.

"O wad some pow'r the giftie gie us

To see oursels as others see us!

Rob't Burns."

Major K. H. Hinchman
Directorate of Aerospace Safe

Readers are invited to contribute their experiences t this "Out of the Looking Glass" feature. (Ed.)

DOWN AND OUT...

George W. Williford, OOAMA, Hill AFB, Utah

Since February, 1962, there have been four reported instances where the B-52 navigator's emergency escape hatch has been accidentally jettisoned during flight. In three of these mishaps crewmembers have been "blown" out of the aircraft, with two fatalities.

The 1962 accident occurred over the North Atlantic at 31,000 feet. The aircraft commander had joined in a search for a malfunctioning radar component and apparently caught his shoe or flight suit under the emergency hatch manual release handle. When depressurization occurred, he fell from the aircraft and his body was never recovered. Unit and command corrective action included warning all crews of the hazard associated with the inadvertent operation of the handle during flight and adding a warning note to mission briefings concerning this hazard. A UR was submitted to require the development and installation of a suitable guard to prevent accidental operation, or the relocation of the handle to a less vulnerable position. Action was initiated to require "Warning" notes to be inserted in the handbooks.

Another accidental hatch jettisoning occurred in March, 1963. In this instance, the radar navigator was sitting on one side of the hatch, with his feet across the hatch. The aircraft was flying at 39,000 feet and somehow the emergency jettison handle was raised. Fortunately, the radar navigator was wearing a chute, and, though he was blown from the aircraft, he survived with only a fractured arm and ankle. The bomb wing was directed by the air division to re-submit the UR concerning the placement of a guard over the handle. The wing was also directed to emphasize the hazards of this system at crew briefings.

Fortunately no crewman was blown out in the third mishap (which occurred in October, 1963). It was assumed that the hatch lever was actuated by an unknown foreign object. Corrective action included briefing all personnel on the danger involved, and a request to quality control to check on a positive lock or cover to prevent recurrence.

Before the third accident, TO 1B-52-1593, 24 July 1963, was published. This TO concerned the installation of a safety guard over the radar-navigator's emergency hatch release handle. Change TO 1B-52-1593C, same subject, was published 12 February 1964. Both of these TO's were to be accomplished at wing-base level.

The last accident occurred in June, 1964. Unfortunately these two TO's were on the list of "TO's not complied with" for this aircraft. At 33,000 feet the navigator requested permission to leave his seat to get a drink of water. Thirty to sixty seconds after he left his seat, the hatch was jettisoned, and the navigator, without a parachute, was blown from the aircraft. Cause: Inadvertent operation of the emergency jettison handle! Corrective action in this case included all wing aircraft on the station having TO 1B-52-1593 and TO 1B-52-1593C complied with by the day following the accident. This is an example of "locking the barn after the horse is stolen."

This problem has been with us since the first accident, February, 1962. The score: four mishaps, three people blown out of aircraft, with two fatalities, all occurring in two years and five months. We all hope this problem has now been permanently cured by thorough education of all crewmembers of the hazards associated with inadvertent activation of this lever and a fix to prevent possible recurrence. ☆

Aerobits

SID Violations—Pilots have been violating Federal Aviation Regulations by not adhering to their SID instructions. Six such violations occurred in the past year and each involved failure to adhere to altitude restrictions when crossing intersections. SID's are displayed in nice little booklets, plain and simple. They are usually in pictorial and narrative form. They depict departure routes and altitude limits and crossing fixes. They are a means for simplifying departures. Then why are there violations?

Basically the violations occurred as a result of the pilots' misinterpreting the altitude instructions received as part of the clearance that is not contained in the SID. Example: ATC clears AF 12345 to ADW AFB via . . ., Plum 6 departure Gettysburg transition maintain FL 250. The FL 250 applies only to that portion of the route following completion of the procedures contained in the SID. It does not supersede the printed altitude restriction. The pilots who were charged with a violation had assumed that the phrase, "maintain FL . . . , " authorized them to deviate from the printed altitudes. The point is to be sure to adhere to the SID altitude procedure when cleared via the SID and, after that, apply the additional instructions concerning altitude cited in the clearance.

In essence, when flying a SID the safest thing to do is to follow the printed instructions verbatim. If for any reason doubt exists, request clarification.

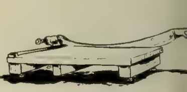
Occasionally, Air Traffic Control will provide radar vectors that differ from the SID route or the instructions may deviate from the printed climb instructions of the SID. When these occur, ask ATC if this action cancels the entire SID.

Harrie D. Riley
Directorate of Aerospace Safet

PAPER CUTTER. When the pilot arrived at the F-102, he noticed the aircraft forms and the ladder lying on the ramp beside the aircraft. Being the thorough type, he checked the forms, placed them back on the ground and proceeded with his walkaround with the transient maintenance crew chief. When they finished the pilot found the ladder in place against the aircraft so he climbed into the cockpit and fired up.

The first sign that all was not as it should be came when a couple of mild compressor stalls occurred as the RPM passed through 80 per cent. However the instruments gave normal indications and the pilot taxied out for takeoff. After the afterburner was lit, the wingman noticed an abnormal flame pattern coming from the tail pipe and notified Lead who aborted and taxied back to the ramp. Inspection of the engine revealed FOD necessitating an engine change. Sure enough, the engine had gobbled up the aircraft forms.

Apparently what happened was that the airman who placed the ladder against the aircraft put the forms in the boundary layer duct. The fact that there were four maintenance men around the aircraft, all attempting to aid the pilot, caused some distraction, possibly some duplication of tasks and deletion of others. The facts that this was a strange base and that the pilot did not know the maintenance men may have contributed to the confusion.



F-100 AIRSPEED INDICATOR—On takeoff, the pilot noted that the line speed was 10 to 15 knots higher than computed. Remainder of flight was normal until the aircraft was in the pattern at destination; there the pilot found the aircraft hard to maneuver and that there was a higher than normal sink rate. Full power was applied but the aircraft hit short of the overrun and the pilot took the aircraft around. He made a successful landing on the second try and ttributed the high sink rate to a strong rosswind.

When approach was made on the return to home base, again sink rate was unusually high and full military power was necessary to complete the landing. On reaching the ramp, the pilot had the airspeed indicator checked. At 180 knots, the indicator was 30 knots high. Consequently, on final approach the aircraft was actually flying at 150 knots with an indicated airspeed of 180.

The base that reported this incident recomends pilots be critical of:

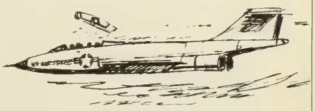
- Line speed computation and check.
- Aircraft that doesn't maneuver properly for IAS.
- Higher than normal angle of attack and power setting for IAS.

DEADLY MISUNDERSTANDING. A recent fatal accident might have been prevented had a pilot not given a "Roger" to a transmission that he did not understand. It is true that the tower warning of conflicting traffic was given using non-standard phraseology. However, a "rogered" transmission is an *understood* transmission and can pass responsibility from one agency to another. In this case a pilot on go-around was advised, on downwind, that he was No. 2, following same type two miles. He "rogered" but misunderstood the instruction, still thinking he was "cleared No. 1" as he had been originally. He continued his approach. Investigators surmised that the pilot of the authorized No. 1 aircraft, on GCA final at night, suddenly found his cockpit flooded with landing lights and shoved forward to avoid a midair. His aircraft struck the ground and was destroyed.

Maj Philip O'Brien
Directorate of Aerospace Safety

F-101 SMOKE, FUMES, BLOWN CANOPY. During taxi for takeoff the equipment cooling out light illuminated. The switch was recycled once but the light stayed on. Radar was turned off and taxi continued. The mission was chase for initial solo and radar would not be required. Both engines were run to full military power for a thrust check and no problems were encountered. Takeoff was a normal burner takeoff with no problems until airborne. As the gear was retracting heavy smoke entered the cockpit. The cabin pressure switch was placed in ram position and the mission aborted. An emergency was declared due to smoke and fumes in the cockpit. These were extremely strong in the rear cockpit and not noticeable in the front cockpit after the cabin pressure switch was in ram position. The aircraft was flown at 320 knots to an eight mile final. As turn to final was being made the canopy blew. The tower was notified that the canopy had blown and that a landing would be accomplished from a straight in approach. The pilot in the rear seat experienced moderate buffeting, however he had no difficulty in movement. He was unable to hear the IP in the front seat at speeds above 240 knots due to the wind blast. Vision was not affected. A heavyweight landing was accomplished successfully.

A clamp on a hot air line in compartment 206L had separated and allowed air to escape into the nose section. This air scorched and melted insulation on wiring and was hot enough to cause the M-3A external canopy initiator to fire and blow the canopy.



Aerobits

COLD WEATHER, ORIT MITO LAUNCHES AND IG'S. The changes in Operational Readiness Inspection Test (ORIT) requirements and the coming of cold weather again make it imperative that all flight supervisory personnel, the commanders, and the Inspector General team chief, carefully weigh the effects of extremely low temperatures on the B-58 aircraft systems. It is fairly safe to assume that sufficient time will be available between engine start and beginning takeoff roll for the engine oil to warm up enough to provide stabilized AC electric power and reliable engine operation; however, the hydraulic fluid required to safely operate the flight controls may not have had time to reach a safe operating viscosity. The Flight Manual has a good discussion on page 9-14 on the symptoms and effects of inadequately warmed hydraulic system (and flight control system) fluid. Responsible personnel must insure adequate system warmup time required for safe operation during sub-zero ORIT Minimum Internal Takeoff (MITO) launches.

LtCol I. D. Rothwell
Directorate of Aerospace Safety

MM-4 ERRORS AGAIN. As a result of another report of erroneous attitude indications on the pilot's MM-4 attitude indicator in a KC-135 we have again been asked to remind pilots of this insidious hazard. Though the "OFF" flag will appear with loss of electrical power, there is no "OFF" flag indication due to MM-4 attitude gyro internal failure. Constant attention of both pilots is essential for safe operation.

For more detail on this problem we recommend rereading "Watch Your Attitude," AEROSPACE SAFEAL, October 1963, page 9.

NEAR MISSES continue to occur in Oil Burner areas. During re-entry to the low level portion of flight the copilot of a B-52 flying at 3500 feet spotted what he described as a medium to large jet about 200 feet away at 3 o'clock. The other aircraft was at the B-52's altitude on a course of about 10 degrees. The heading of the bomber was 355 degrees.

The copilot could not identify the other aircraft so it is not known whether it was military or civilian. Regardless Oil Burner routes are adequately published. Plan to avoid these areas at the times and altitudes indicated. ☆

FALLOUT continued

ing the bird. (Note I have omitted such other distractions as finding the flashlight or turning up the friendly red lights so I can read.)

Now let's assume we're within 20 miles of the holding fix and you vaguely recall procedures outlined in the AF Manual prescribing the most current accepted method of entering a holding pattern which stated, "If you arrive at the approach fix on a heading within 70 degrees of the published inbound course on the maneuvering side, turn outbound on the maneuvering side to parallel the reciprocal of the inbound course." (I don't want you to think I memorized the above quote so I'll be perfectly frank and tell you now that I copied directly from AFM 51-37.) Now we're using another terminology and thereby further complicating the old Jock's thought process while he is frantically trying to form a mental picture of what the maneuver he is doing in the air is supposed to look like on the ground. I assure you he will get into the holding pattern, but he will use up valuable seconds or maybe minutes in the process. And it just ain't necessary in the first place.

Had this gent told me to proceed on a heading of 247 degrees to a 20 mile DME reading, or an intersection of a well known VOR, the adrenalin would have remained in place, no violent maneuvers would have occurred and the purpose would have been adequately served. Meantime, back at the ranch, Joe, the unbiased controller, drinking his coffee and munching a sandwich, working from a 20-inch scope with protractors, computers and other tools of the trade lying nearby on a good flat surface, doesn't encounter all these problems.

I know all about radials emanating outward from a center point — and that we had to come up with some common denom nator that all people in the flying racket u derstand and all the rest of that jazz, bu why, for Pete's sake, did we have to pu the monkey on the jock's back and make hi go through all these mental gymnastics whe the guy on the ground, in a very normal e vironment and with all kinds of radar ava able, could do it just as well and muc safer?

The fact that we have been following the procedures for 10 years doesn't mean th can't be changed. We're really in the mid of a navigational renaissance and ma changes are in the making. If you ha strong feelings on the subject one way the other, let me know. I've got a few frien left in the business and you'd be surpris what might come out of the whole thing.

Col. James G. Fussell
Directorate of Aerospace Saf

WELL DONE

A1C
RONALD G. BROWNING
Flight Engineer

Captain
DOYLE J. TAYLOR
Pilot

Major
EARLE P. NASE
Instructor Pilot

1001 AIR BASE WING, ANDREWS AFB, WASHINGTON, D.C.

On a VT-29B orientation flight, Captain Taylor prepared for a landing and called for gear down. The gear lever would not go to the full down position. With the gear handle in this position the nose and left main gear came down and checked normal. The nose and left main gear were retracted and all gears indicated up. Brake and main hydraulic system pressures remained normal throughout the flight.

Several attempts were made to lower the gear without success. The emergency air system procedure for releasing the uplocks was tried following T.O. procedure. The right main gear remained up even though abrupt maneuvers under various configurations were tried.

Since all previous efforts had failed to extend the right main gear, the flight engineer, Airman Browning, and Captain Taylor started the tracing of the gear handle cables. They removed paneling and flooring from the pilots' pedestal back to where the wing joins the fuselage. Identification of the proper cable was made by checking for cable movement when the gear handle was moved. The engineer, with gloves and pliers, pulled on the gear cable after receiving a prearranged signal from Major Nase or Captain Taylor. Various configurations using the gear handle and by-pass valve and hand pressure on the cable failed to lower the right main gear.

Airman Browning and Captain Taylor hooked a tie-down belt to the cable leading to the right gear uplock. The gear handle was again placed in the down position resulting in the nose and left main gear extending. The by-pass valve was then placed in the up position and on a pre-arranged signal the engineer pulled on the tie-down belt as the pilot actuated the emergency landing gear uplatch release. The right main gear uplock released and the gear locked in the down position.

Major Nase then made a normal touchdown, cutting the engines on the runway.

During the installation of the gear down lock pins a check of the right gear uplock was made. Movement of the lock caused a small Phillips head screw to fall to the pavement. Investigation revealed that this screw prevented movement of the uplock to the release position.

The actions of this crew reflect credit upon themselves and the United States Air Force. Well Done! ☆

XB-70

What's New

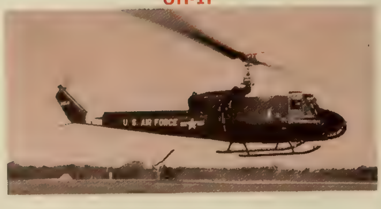
YF-12A

YAT-37B

T-41A

F-5A

UH-1F



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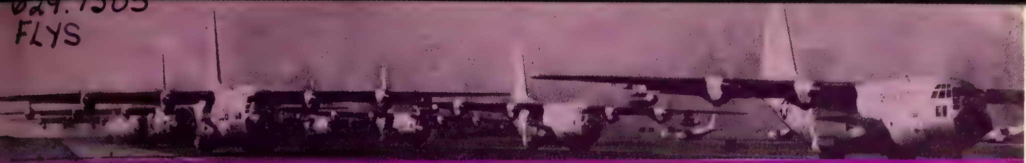

AEROSPACE SAFETY

UNITED STATES AIR FORCE

FEBRUARY 1965

SKY SOLDIER page fourteen

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AEROSPACE SAFETY

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Lieutenant General Keith K. Compton — The Inspector General, USAF
Major General Bertram C. Harrison — Deputy The Inspector General, USAF
Brigadier General Jay T. Robbins — Director of Aerospace Safety
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AFRP 62-1 FEBRUARY 1965 VOLUME 21 NUMBER 2

FALLOUT

BAD BRAKES

The basic tips for crewmembers to lesse
the hazard of brake/wheel fires, page 2
Sept. issue, are real fine as far as they g
but what about warning the crewmembers
stay the heck away from the brakes *after* th
aircraft stops? The fire fighters aren't th
only ones who are exposed to the explosio
hazard.

On a technical visit to an AFSC statio
I rode with the fire chief to an emergenc
declared by a transient C-130 whic
landed, fairly heavy, with No. 1 feathere
—with the result that when he turned o
the runway onto the taxiway, the righ
brakes were white-hot and dripping gob
of metal. So the crew stopped the aircra
on the taxiway—and what was the fir
thing they did? They got out to gawk
the brakes, just abeam of the wheel,
precisely the position of greatest hazard.

Our fire departments follow th
procedure of using minimum amounts
CB, in the event there is a fire. If th
brake is merely hot—smoking—we let it a
cool, preferably all out by itself, like on
power check pad or other unoccupied hu
of geography so that if there is a subseque
explosion we won't kill people or bang
other aircraft. If our firefighters approach
brake fire, they do it from ahead or behind
never beam on.

I might suggest that attention be draw
to the Dash One procedures for the F
type aircraft, particularly the spotting
spiked planks for deflating tires in t
event of a brake/wheel fire. This nee
pre-planned coordination between the fir
fighters who carry and position the spik
planks, and the aircraft drivers who shou
stay in the front office and taxi the b
over the planks. Specifically, stress "p
planned," since the normal action taken
the pilot is to stop the aircraft and adm
the subsequent proceedings from afar. M
firefighters are not checked out in taxiing
aircraft.

Martin P. Casey
Fire Protection Engineer
AFSC, Andrews AFB

SEVEN SECONDS

I wish to take exception to the statem
on page 8 of the October issue, wherein
statement is made: "The average time ta
to read a standard Air Force aircraft altime
is seven seconds."

If you time seven seconds by a sw
second hand, you will realize that anyo
who is that slow reading an altimeter sho
not be flying an airplane. I would be v
interested in learning where this figure
derived from.

We, in this office, enjoy your magazine.

Major R. R. Lawrence
Fairchild-St. Augustine CM
St. Augustine, Fla.

Time to read an altimeter was determi
during an experiment conducted in 1947.
Walter Grether at the Aeromedical Laborat
Wright-Patterson AFB, ran the experiment.

Keep the elephants moving

As we start into another year, I would like to comment on how things are going in this business of preventing accidents. I will have to qualify this slightly since magazine production timetables require that this copy be prepared before all the information on 1964 is complete. However, assuming no drastic change, we can forecast performance through the end of calendar 1964.

The inescapable conclusion is that even holding the line on accidents is hard, continuing work that needs the attention of every one of us in the Air Force, as well as everyone in our supporting organizations. This is obvious when we compare accident rates, PMV and aircraft fatality rates, aircraft destroyed rates and mishaps of all kinds in the growing missile inventory. Last year some rates were up slightly, some down, but we held the line overall. To do this required a lot of people working a lot of hours at this business of safety. In addition to experts within our own ranks we called upon those in industry for all-out efforts when major deficiencies came to light.

Late last year I visited USAF Headquarters and Air Force major commands to brief commanders and their staffs on the USAF accident picture. My goal in these briefings was twofold: to focus attention on the problem areas that are most severely crippling our combat potential and to discuss ways of more effectively tackling these areas. I can assure you that your commanders share my concern for safety. They, too, realize that safety officers and industry specialists cannot fight the battle successfully alone. Every individual supervising, operating, maintaining and supporting our weapon systems must join the team. Our newer equipment is more complex, tolerances are more critical than they have ever been and some of our older equipment is now beginning to cause trouble from normal wear and tear—flight control problems in our older century series fighters being an example.

Records here in the Directorate of Aerospace Safety disclose that the maintenance-materiel area is our leading accident cause factor. Operator error type accidents are second. Admittedly, many "pilot error" type accidents still occur, and most are preventable, but on the other hand our operators are preventing many more accidents than they are causing. There is no doubt that, at this stage, if we are to make any substantial inroads in accident prevention in the year ahead, we must have better quality control, better hardware and the continued best efforts of dedicated aircrew and maintenance people.

I believe the path ahead can be negotiated with minimum risk, provided we know the hazards we face and operate accordingly.

We must cut down on our backlog of Time Compliance Tech Orders. We know that accidents result when things are not done, or are done incorrectly. The fact that there may be a very plausible reason for non-compliance has no value as far as preventing accidents is concerned.

It is likewise true that no *apparent* efforts, such as implementing directives, are of any real value whatsoever until the *intent* is fulfilled.

Utopia doesn't exist in the safety business. There are always shortages of skills, unforecast operational requirements, additional duties, special projects, personnel changes, etc., to be faced. These are normal. The military establishment must stay flexible, must be able to adjust to changing situations and still get the job done. Hannibal's legions probably had difficulty getting elephants across the snow-covered Alps. But I imagine they soon learned that sympathy seeking was a waste of time, that the only effective action was making the elephants move. If we are to hold the line this year, and on into the future, it will be by hard work. We won't get the job done merely by crossing our fingers and hoping accidents won't happen.

Excuses are never solutions, only temporary crutches to postpone ultimate failure. Even if hazards appear to loom ahead like Alps, the requirement is clear. We have to keep the elephants moving!

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

ZERO DELAY LANYARD

A study of the use and non-use of the zero delay lanyard in USAF ejections was initiated in September, 1963, by this headquarters. As a result of this study and subsequent conferences with personnel of the Systems Engineering Group (SEG), it was concluded that a revision of the existing zero delay lanyard requirement was in order to improve the success of low level ejection.

The new procedure agreed upon was: keep the lanyard hooked at all times below 10,000 feet and hook it at high fix on penetrations and at 10,000 feet on en route descents. It was expected that this revised procedure would be immediately reflected in the Dash Ones. This has not happened in all cases. However, this revision is expected to become effective for all aircraft at about the time you read this.

obert H. Shannon, Safety Officer, Assistant for Medical Services

The purpose of this article is to explain the reasons
ehind the change in use of the zero delay lanyard.

Basis for the change is simply USAF ejection ex-
erience. This experience shows that the probability of
urvival in low level ejection is greatly enhanced by
ttachment of the lanyard. On the other hand, failure
o attach the lanyard for low altitude ejection has con-
ributed to a significant number of fatalities.

Now to clear up some points of dispute:

Although it would seem obvious that use of the zero
nyard would increase the probability of seat/chute
ntanglement, our studies do not show a positive cor-
elation. Entanglement has occurred under varying
onditions of flight (high speed, low speed, high alti-
ude, low altitude, controlled and uncontrolled) with
nd without the lanyard attached. In general, the
an/seat separator has reduced seat/chute entangle-
ent, particularly in ballistic ejections. In contrast to
his general downward trend, the recent increase
oted has been primarily associated with rocket as-
sted ejections. During the period 1 January 1958-
1 May 1964, there were 140 rocket ejections. In 18
14 per cent) of these cases, there was seat/chute in-
olvement. This compares to 38 (4 per cent) cases
1003 ballistic ejections during the same period. The
stained thrust of the rocket seat, particularly at low-
speeds, is a probable contributing factor in the
creased incidence of seat/chute entanglement in
cket ejections. This resultant lack of differential in
erodynamic forces is further compounded by any at-
chments between the man and the seat. Such attach-
ents include personal leads and the chute arming
nyard as well as the zero delay lanyard. In the above
ited 18 cases of seat/chute involvement during rocket
ections, the zero lanyard was connected in eight
ases and not connected in nine cases (one involved
e F-106 "B" seat).

With regard to the hazard associated with high
eed, high altitude ejection, with lanyard attached,
years of ejection history and close to 3000 ejections
ave emphatically proven this to be a minor concern.
pproximately 95 per cent of all ejections are made
low 400 KIAS with only two per cent at speeds
er 500 knots. The average IAS at time of ejec-
n ranges between 200 and 225 knots. Only eight
r cent of the ejections are initiated above 20,000
et and the majority of these are between 20,-
0 and 30,000 feet. The average ejection altitude is
ss than 10,000 feet. Experience has shown that, bar-
ng a catastrophic situation, when an emergency
cessitating ejection occurs at high speed or high alti-
de, there was usually time to slow the aircraft down
preciably or descend to a lower altitude, or both,
fore ejecting. In the event of a catastrophic situa-
n (severe uncontrollable condition or break up of
aircraft), ejection is the only means of survival
gardless of speed or altitude.

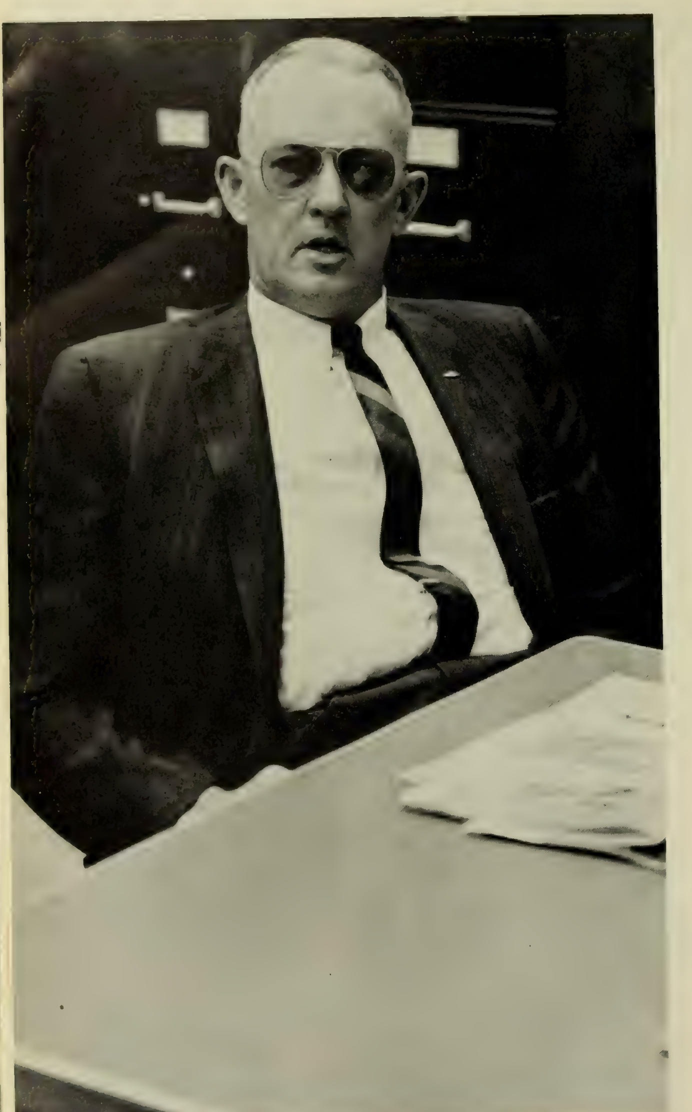
There has not been a single ejection fatality in the USAF definitely attributable to parachute opening shock. The few high speed ejection fatalities are attributable to either severe flailing or ram air pressure (high "Q" force), or both, occurring before parachute opening. Even in these cases, seldom has extensive chute damage occurred. The threshold value for lethal injury resulting from ram air pressure, according to a study by Stapp and Neely "High Speed and Thunderstorm Effects on USAF Ejections," is approximately 8.5 psi. This is equivalent to an IAS of approximately 600 knots at sea level. Lethal flailing injuries, however, could occur at slightly lower speeds. In a high speed ejection, the velocity of the seat/man mass will decelerate from 25 to 50 per cent during the first one to two seconds. Therefore, the chute will deploy near or within its structural limitations as well as within man's physiological tolerances.

We do not consider the zero lanyard as optimum equipment. It was introduced some six years ago as an interim measure to enhance the success of low level escape. The advantage of the additional one second afforded by this equipment far outweighs any of its disadvantages. Improved zero/zero systems are being successfully tested and should begin to show up in Air Force equipment in the near future. In the meantime, existing equipment such as the zero delay lanyard must continue to be employed.

In the 15 years of USAF ejection history, over 500 USAF crewmembers have been killed. Seventy-seven per cent of these were killed as a result of ground impact with an unopened or partially opened parachute. Most fatalities resulted from attempted ejection outside the existing low level capability of the system. Until the optimum escape system is in use, one that insures safe egress within both extremes of the aircraft operating envelope, efforts must be concentrated in the most critical areas. These are, irrefutably, low altitude and slow speed.

REVISED ZERO DELAY LANYARD PROCEDURES

- **Connect the lanyard prior to takeoff and disconnect before reaching 10,000 feet.**
- **The lanyard should be left connected for missions and flights in which 10,000 feet will not be exceeded, to include missions where a maneuver may temporarily exceed 10,000 feet.**
- **Connect the lanyard prior to high fix, or on passing through 10,000 feet during enroute descent.** ☆



Tony LeVier's first remark, as he sat across the desk, was that he can not get by with everything in an airplane, despite what others may believe. "I've flown a lot of airplanes for the first time . . . but you can bet I knew the airplane pretty well. I lived with it . . . made taxi tests with it . . . kept notes of characteristics I'd noticed and when it was time for the first flight I always felt I knew that airplane as well as one possibly could."

TIPS
FROM

An aviation legend walked int
the office the other day, sa
down and gave some off
the-cuff views on accident prevention for the readers of AEROSPACE SAFETY magazine. Thi
man, A. W. "Tony" LeVier, Direc
tor of Flying Operations for Lock
heed, is well known to long-tim
readers of this magazine, but fo
any newcomers we present a brie
résumé.

Tony first flew when he was 1
years old. He had been "hooked
ever since he could remember, bu
it was in 1928, when he was 15, tha
he found a fortune—a ten dolla
bill in a theater aisle. This immens
wealth provided him the where
withall to purchase his first fligh
instruction. He had found hi
lifework, but he didn't solo until h
was 17, after scraping and savin
the necessary funds to finally ac
cumulate nearly eight hours o
flying time. From then on he liter
ally lived at airports, every cent h
could spare going for more pre
cious flying time; two years late
he had a grand total of 200 hou
and a transport rating. From h
logbook it would appear that h
would fly anything with wing
And, given the chance, he woul
fly it first. He's credited with 1
firsts, starting with a frail-lookin
Pietenpol monoplane in 1933, an
including such famous aircraft a
the XP-80A, T-33, F-94A and 1
XF-104 and the U-2.

But, sitting across the desk h
made the point at the outset tha
despite what many may believe, h
can't get by with everything in a
airplane. He, in self analysis, rate
himself as an average pilot. Eve
man is entitled to his own opinio
but most of us will agree that To
LeVier is far above average as

TONY LEVIER

pilot. Here may be one of the real nuggets to come out of his views on safety—he doesn't consider himself to be infallible, or anywhere near infallible, no matter what others may tell him. In fact, by his own admission, if there is anything natural born or instinctive about his ability as a pilot it is the respect he has always held for airplanes and his own limitations. As he put it, every pilot should carefully assess his own limitations, then never attempt to operate outside those limitations.

This brought him to his next point, and the one which he pressed more than any other—self discipline. Self-discipline he conends, includes a continual health and physical conditioning campaign. There are times in a pilot's career, especially if he specializes n racing and test work, when his every faculty is required in split second decisions and reactions. It's oo late to start a 5BX program hen. When your tiny racing plane lips inverted at 75 feet, sluggish reactions won't hack it. He recalled a recent accident in which a Cenury Series pilot, buzzing a boat, attempted a roll, crashed into the water, killed himself and cost the Air Force a first line aircraft. Obviously, he contended, this pilot displayed a complete lack of self-discipline, since the hazard of atempting such a maneuver on the deck has long been known.

To further emphasize the importance of operating within safe imitations, he told of a company pilot who put on demonstrations of precision flying at low altitude. As he became more skilled he cut down the safety margin. Finally, ne day, one little thing went wrong, he had no margin left, and he killed himself. When you recall that Tony LeVier's career as a racing and test pilot spans over 30 years it is not difficult to imagine that he has lost many associates and friends who shaved their safety margin too thin then, with a slight misjudgment or mechanical problem, bought the farm.

We asked Tony to compare modern aircraft with those of World War II vintage: "Are aircraft really more demanding today?" After reflecting a moment, he pointed out that as long as he can remember people have been saying that current aircraft are tougher to fly. "They said it 20 years ago about the P-38 and they still say it," he said, "but this is a relative thing. I would say the requirements today are a lot stiffer than 15 or 20 years ago—the requirements at each point along the way. Today airplanes are more demanding but we are training for it. If you want to get down to opinions, I would say the military pilot today is better trained than he was in World War II. Pilots get the same sort of training generally, but they are thinking more deeply today.

"For example, I can remember when we came out with an airplane called the F-94C. It was supposed to be better than the '94A and B. Performance was much better than that of the two earlier models. An Air Force colonel questioned me, 'How can our young second lieutenants fly this airplane? They will crash all over the place.'

"I told him what I still believe is true, that while the aircraft have changed, so have the pilots, primarily through better training. Today we have the best trained and best qualified pilots in history. They're trained to fly high performance aircraft, therefore, although the airplane might be more sophisticated, so is the pilot. In other words, his capability matches the airplane today just as well as was the case 20 years ago.

"I had it asked of me 10 years ago. If you build and design an airplane with the idea that a man can fly that airplane, then man can fly it. If it meets the requirements set up by the customer, a man can fly it. If you give them adequate training, most pilots should be able to fly such aircraft. In the old days in the P-38 and all old planes, hardly ever was a pilot checked out properly. Sometimes the crew chief simply showed him the cockpit.

"Along with self-discipline, you can't beat good judgment," Tony pointed out. For an example, he took the Split-S maneuver. "You've got to know your own limitations and those of the aircraft. Below a certain altitude for a specific airplane, you're dead. It just isn't possible to pull out. If a pilot knows the airplane and his own skill, then judgment takes over. Without using good judgment a pilot might try to cheat a little—Split-S at too low an altitude. There's only going to be one loser in this game and there's no question about who it's going to be.

"Getting back to the demands of modern aircraft," he said, "I've flown a lot of airplanes for the first time. There wasn't any Dash One, I had to write my own. But you can bet that I knew the airplane pretty well. I lived with it all the way through design and production. Then I made taxi tests with it, even getting it off the ground for a few feet to see how she felt. I kept notes of characteristics I'd noticed and

. . . he doesn't consider himself infallible or anywhere near infallible, no matter what others may tell him.

when it was time for the first flight I always felt I knew that airplane as well as one possibly could without having actually had it in the air."

We led into the landing problem by recalling that one-third of our accidents come on landing and that half of these are caused by pilot error. Tony was quick with a suggested reason (this has been a pet subject he's covered in this magazine in the past): too many pilots want to set the bird down right on the end and, as a result, get too low and too slow. Landing short, the leading pilot-caused landing accident problem, can also stem from a steep approach, he emphasized. Come down final in the over-four-degree slope range and you are soon going to land the bird hard, and very likely bash it for good, he points out. Get up around six degrees and flare is nearly impossible due to exceeding the CL max limits at the flare. He was the first to deadstick an F-104. His engine had flamed out and when he discovered he had no leading edge flaps he confessed he would have punched out except that, at low altitude, he didn't have a chance with the downward ejection seat in the early model. He had to ride it in, but fortunately he was able to play speed and flare so as to get it down on a dry lake bed.

He hasn't always been this fortunate. With some hesitancy (why anyone would hesitate to trust an editor, we'll never know) he pulled a sheaf of paper from an inside jacket pocket and let us look at it. The title of this six page true confession was *The Case of the Delinquent Aviator*. With candor few people possess, Tony lists the most unique qualifications we've ever seen for views on accident prevention. It's long and detailed, but remember, this currently qualified F-104 pilot has a career that dates back to barnstorming days before many present military pilots were born. In many cases he had to try it first. He didn't have the advantage of learning from others. Now, in the pages of AEROSPACE SAFETY magazine, he shares selected experiences so that others may learn the safe way. Here's the breakdown Tony made on himself: 94 accidents and incidents, 8 crashes, 59 near crashes, 5 tailspins to ground level, 26 forced landings, 31 engine failures, 5 canopies lost, 20½ pilot errors, 37 material failures, 1 midair, 9 near midairs, 7½ aero phenomena, 4 occupational hazards, 38 different aircraft.

Tony had his first close call in 1930. He got into a power spin in a Waco 10 biplane. He was doing low altitude acrobatics at the time. He chalks this one up to pilot error.

Thirty-five years ago, flying a Travel Air 4000 in haze, he had his first near midair collision. This problem, which he agrees is as bad or worse today, he shrugs off as an occupational hazard.

He faced his first materiel problem in 1931 when an exhaust pushrod let go on a Wallace Touroplane and he made his first forced landing.

Two years later, when airport lighting was primitive (if existent at all) he missed the field one night with a Travel Air 6000 and ran into a ditch. The dollar loss he remembers was $75—all out of the pilot's pocket.

Acrobatics taught him a lot about what he calls aeronautical phenomena. Sometimes the lessons are particularly vivid. He got into an inverted falling leaf in an OX5 Travel Air and had a real affinity for spins at low altitude. He survived one at 300 feet in his Great Lakes Trainer.

His lesson on improper CG came the hard way—he spun a T. P. Swallow at low altitude because of it.

Weather plagued him too. He made a forced landing in a Porterfield when he got carburetor ice. His plane had no carburetor heat. Later, in the same plane, he got lost in fog. He gives the reason as improper flight planning and says nobody was to blame but the pilot.

He got his first real taste of racing planes in 1935 and promptly made a forced landing in a Mendenhall Special when a magneto failed. A few days later he crash landed it after takeoff when the carburetor fell off.

He learned the need for takeoff planning in the days before performance charts. He snagged a fence on takeoff in an International. This he charges off to occupational hazard. The $5.00 repair bil to fix the fence helps him remember. These were the thin depressio years.

He experienced design deficiency in 1936 when the canop blew off his Pobjoy Racer due t faulty design of the latching mechanism. Tony won his first big race the 200 mile Greve Trophy race a Cleveland, in the Schoenfeld Firecracker in 1938. But the gea couldn't take the strain of the roug landing field and his plane cam unglued during the landing.

From 1942 through 1944 h successfully coped with 14 engin failures in P-38's. Twice he got los above weather over England in P 38's, once during his first encounte with a jet stream and the other tim when his radios failed. His firs midair collision occurred in a P-3 during a dog fight with five F-4U (other pilot's fault).

In 1944 he made his first flame out landing in the XP-80A. In 194 he lost a $1,000,000 airplane an suffered his most serious injury, broken back, when a turbine whe chopped the tail off an XP-80 during a maximum speed run 10,000 feet. When the tail came the plane began to tumble so v olently he became nothing mo than a helpless passenger. Fort nately the tumbling let up enou to enable him to pull the canopy r lease. When he hit the catch on h seat belt on the second try he w literally catapulted out of the tur bling airplane. Because of his spe he feared his chute might rip if opened it. While he delayed he sa beside him, and moving at abo the same speed, the tail-less, tur bling P-80. Chute opening prov no problem but due to oscillatio near the ground he came in as out of a high swing and the grou hit him "like a sledge." This bro his back.

He experienced rapid deco pression in the XR-6VI Constit

"Along with self-discipline, you can't beat good judgment," Tony pointed out. "You've got to know your own limitations and those of your aircraft."

Among the highlights of Tony LeVier's aviation career were air races in his Cosmic Wind racer "Little Toni," and test flights in the XP-80A. He is currently a qualified F-104 pilot and is Director of Flight Operations at Lockheed, Burbank, Calif.

tion when a window blew out over his head. He successfully belly landed the XF-90 when the gear failed to extend and has lost control in this airplane and in the F-94 during supersonic dive tests.

One of his closest scrapes came in 1952 when another aircraft, flying IFR on a VFR clearance, almost hit him.

He relearned an old lesson and icked up a few more gray hairs when he tried to land in calm air oo close behind an R4D and his Bonanza flipped inverted on final.

Another thrill came in 1954 when e first experienced pitch-up in the F-104.

In the past decade the number of ear midairs have increased markedly and provided him with is closest brushes with the old cythe swinger.

Last year? Nothing much except e didn't see the wires and flew hrough them with a helicopter.

Most of the bad things that can happen in an airplane have happened to Tony LeVier. He doesn't want them to happen to others. With strong personal discipline, he says, pilots need not repeat the same type of pilot error accidents. Landing, he points out as an example, is like a horizontal Split S, and if you steepen the bank and rack it in, and keep cutting your margin, one day you'll stall and bash your bird.

He says we have to emphasize this business of discipline and good judgment and we have to relate experiences that may serve to deter others from repeating aircraft accidents. Aircraft are more demanding, and the chances of walking way from an accident are becoming less and less, particularly in jets. But, he adds, training is much better, we have a great wealth of experience, and if we exercise self-discipline and learn from the mistakes of others we do not have to repeat them.

For Air Force safety officers LeVier had some encouraging words. As he prepared to walk out the door to a waiting aircraft we asked him the weight he would give to a safety program.

He replied, using an analogy, "If you had so much money to spend and that money would buy 1000 airplanes, down the road somewhere you would have more of them left if, instead of buying a thousand, you bought 950 and put the money for the other 50 into training, safety education and aircraft mods." ☆

BYLINE OMITTED

Aerospace Safety Magazine regrets the failure to credit Archie Caldwell, Directorate of Aerospace Safety, as the author of *Guns Don't Kill . . . People Do*, page nineteen, January 1965.

A Fighter Pilot's Share

By a student attending the USC FSO course

I'm a fighter pilot. I've been asked to do a safety story. To come up with one I've been remembering past experiences and recalling hairy tales and war stories from stag bar bull sessions.

But, I've got to be truthful. My close brushes with death have not occurred in the T-Bird, the F-86 or the F-106. They've occurred in that much less glamorous, much more dangerous weapon system — the family automobile! I'd rather do a story on airplanes because I think they are much more exciting, but if I'm honest with myself, I've got to tell you about the real killer.

I became impressed on my first tour in Europe. At the time I was in an F-86 outfit. During happy hour, while we were talking airplanes, a couple of us decided to go to a local restaurant for a real gourmet feast. We took quick showers, hopped into my oversized American car and headed for town. We were in a hurry; didn't even have time to fasten the seat belts. Although I thought I was paying close attention to the narrow, winding road, the car got into a skid while rounding a curve, went off the road and bounced off an iron railing. Through no skill on my part, the car came back onto the road and slid to a stop at the edge of a small village. Luckily we weren't injured. We got out to look at the damaged front end. We stood there a while, examining the mangled iron in the pungent "Smog" formed by columns of steam arising from the customary manure piles that decorated the immediate landscape. Soon several of the local citizenry joined to peer at us, point at my damaged car and jabber about the excitement we'd caused.

I learned something from this personal experience. The fact that the base commander later revoked my driver's license for 30 days (reckless driving) probably helped me remember. As I think back, it could have been worse, much worse: we could have been injured, or killed, the car could have been demolished, the report could have carried a notation on my prior presence at the Happy Hour function.

Here's another reason why, when asked to do a story on safety, I have to go to the PMV route. In the three years that I was stationed in Europe, my squadron did not lose a single pilot in an aircraft accident. That was an all-weather interceptor outfit operating in some of the worst flying weather in the world. Yet, during that same three-year period, *five* of our squadron pilots were killed in automobile accidents. In addition, two other pilots were severely injured in an accident and were lost to the squadron for more than 90 days.

It seems especially tragic to me when a pilot gets killed in an automobile accident. If a pilot dies in an aircraft accident you can rationalize and say, "Well, he was a professional pilot, a military man and he lost his life while serving his country." Such is not the case in a car accident. Here is a man with invaluable training and experience who is a vital part of the Air Force combat capability. If he dies, both the Air Force and his country suffer. This is to say nothing of the man's family and friends.

When I look at this business o safety objectively and try to fulfil this assignment on safety, I hav got to hit at the Number On hazard as I see it. The primar objective of our safety program i to prevent accidents and to con serve the combat capability of th Air Force. Let's apply the medicin where the hurt is.

Each man in the Air Force mus be made to realize his obligation t preserve his share of the country' combat capability—himself. Eac time he gets into his car he shoul say to himself, "I'll drive as if m life depended on it."

Let's face it, friend; your lif does! ☆

Seat Belts

"I was returning to the support base, alone, from one of our launch control facilities. The military station wagon I was driving gave me only a few seconds notice before it started to roll to the left. I grabbed the steering wheel with both hands and hung on. As it rolled to the left and hit the road, I saw the windshield crack in a million places and heard the breaking of glass behind me. Going over the top and to the right-side-up position, I still held on to the steering wheel and could feel the car roll again to the left. This time the entire windshield blew outward. On the second roll it was harder to hold the wheel. Again there was the sound of breaking glass and the crunch of metal. The car came to rest right side up. After a moment and a deep breath I looked around and saw that every window, with the exception of the two wings and the one in the right rear door, was broken. Both front doors were jammed shut, so I climbed over the seat and out the right rear door.

"The car was beyond repair. The hood, which evidently had come off the first time over, was now standing upright partly embedde in the right front fender and part under the right front wheel. Loos gear and the back seat had bee thrown clear and were now strew on the road. The roof was crun pled, and if I had been driving wit an arm out the window it w obvious I would have lost it. Ther was a slight cut on my thumb, m cap was still on and a few muscl felt stiff. Otherwise, I was okay.

"It was several hours later that noticed two bruises, one on eac thigh. The seat belt which held m tightly in place had left a remin er." ☆

A Missile Combat Crewmemb

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Have a question on instrument flying? Send it to the USAF Instrument Pilot Instructor School (ATC), Randolph AFB, Texas.

Q. some of the instructors of our organization are of the opinion that if the approach chart omits "Localizer Only" minima, the published circling minimum altitude applies. The 300-foot and one-mile "Localizer Only" minima apply only when published. The other group of instructors feel that 300 feet and one mile apply unless specifically indicated higher or not authorized. Which group is correct?—*Captain J. F. Hufaker, 62nd Troop Carrier Wing, McChord AFB, Wash.*

A. When ILS "Localizer Only" minima are not published, and a "Localizer Only" approach is being made, the pilot should not descend below the published circling minimum altitude established for that aerodrome.

"Localizer Only" minima referred to in par 40b (5), AFR 60-16 and par 3a, AFR 60-27, are the lowest possible ceiling and visibility that the Air Force will accept for publication. In a situation where published minima at non-Air Force installations are lower than those listed in AFR 60-16, Air Force minima will apply.

The published "Localizer Only" weather minima serve two purposes for the pilot:

(1) To determine if the existing weather is at or above the published minima to initiate the approach, and

(2) By adding the published "Localizer Only" weather ceiling to the field elevation, he can determine the minimum indicated altitude to which he can descend on that approach. For example, the minimum ndicated altitude for a "Localizer Only" approach at McChord is 722 feet. (400-foot weather ceiling plus 322-foot field elevation.)

Although it is not stated in AFR 60-16 or AFR 60-27, the "Localizer Only" weather minima do not include obstruction clearance in accordance with JAFM 55-9, Criteria for Standard Instrument Approach Procedures. The obstruction clearances required for a Circling Approach" (Par 1.0800) and a "Localizer Only" approach (Par 5.0702) in JAF 55-9 are 300 feet. Thus, a pilot who misinterprets AFR 60-1 and decends to 300 feet above the field elevation may not be provided the required 300 obstruction clearance. The seriousness of such a misinterpretation can best be illustrated by the following examples:

(A Western Aerodrome)—A descent to 300 feet bove the field elevation during final approach, without glide slope, would place the aircraft 125 feet bove a 301-foot obstruction located within the final pproach area. Discounting altimeter errors, an aircraft would clear the obstruction. However, the aircraft would be 175 feet BELOW the 300-foot obstruction clearance required by JAFM 55-9.

(An Eastern Aerodrome)—This instrument approach indicates an obstruction of 551 feet MSL within the final approach area. The pilot who interprets AFR 60-16 (300-1) as his authorized minimum altitude without glide slope, would descend to 300 feet above field elevation or 545 feet MSL. This would place the aircraft six feet BELOW the obstruction. Pilot adherence to the published circling minimum altitude will provide adequate obstruction clearance in both cases. These examples were not selected to "point the finger" at any base, but serve to indicate a deficiency that exists when "Localizer Only" minima are not published.

POINT TO PONDER. "What can I do about the '40-degree error' in TACAN bearing information?" This is a question we often hear and for which there is no cut and dried answer.

The error is caused by erroneous measurement of one of the phases of the signal transmitted by the ground station. This occurs most often when the aircraft is in a "fringe" area such as near the cone of confusion or near the maximum range of the facility.

Recognizing the 40-degree error is normally no problem because the heading required to maintain a course will be in gross disagreement with the selected course.

Methods of correcting the 40-degree error are limited. In many cases the equipment will correct itself when the aircraft is flown away from the "fringe" area. If the error persists you can sometimes correct it by rechanneling or turning your receiver off and then on again.

If you encounter the 40-degree error (remember it can be 40 degrees or a multiple of 40 degeees), you should consider the bearing information unreliable. Adding or subtracting the error and continuing to rely on the TACAN bearing information is certainly not recommended. If your aircraft is TACAN-only equipped you will have to rely on some other method of recovery to your destination, such as RADAR or DF.

Proper preflight planning and a constant awareness of your position in flight is the key to avoiding trouble caused by the TACAN 40-degree error. ☆

SHAKY'S SUCCESSOR

By Major T. J. Slaybaugh

Oceans will shrink, instrument reading (even at night) will be easy, vibrations will virtually cease, the noise level will drop markedly and the clouds flown in for so long will be far below.

These are a few of the outstanding impressions in store for MATS C-124 crews once they begin flying missions in the latest MATS transport, the C-141.

When we learned that the first C-141 (The Spirit of Oklahoma City) had been delivered to the "University of MATS" at Tinker AFB we arranged to go on a flight to report some impressions. The MATSmen waiting impatiently to fly airlift missions have every reason to be impatient. Major M. D. Rich, the first pilot to enter C-141 training direct from C-124's, is enthusiastic. Lt. Colonel E. E. Schleier, Jr., a veteran C-135 pilot and commander of the 1741st ATS at Tinker, compares the '141 favorably with the '135, an aircraft of proven reliability and well liked by the crews. Instructor Pilot Captain George Mizell says any qualified transport pilot should have no difficulty transitioning to the '141. His opinion is worth considering. He is one of a small handful of MATSmen to survive the careful screening that selected the best qualified men in MATS—pilots, navigators and engineers—for the initial instructor cadre. He came from a C-135 squadron at McGuire, and before that flew the line in C-118's and C-54's.

But let's get aboard; find out how this large, but compact transport flies. Naturally, we've figured takeoff performance and completed thorough preflight checks. We enter the long cargo compartment through a crew door on the left forward fuselage. A few steps up a short ladder and we're in the "office." Immediately we're impressed with this layout. There is plenty of elbow room. The "chairs" are as good as any in MATS. The pilots can adjust forward, back, up and down and sideways. Two things stand out as soon as you're in a pilot seat—the nearness of the ground and the visibility. You're really up front in this one and you have practically a picture window at each side. Oh, we forgot one thing about the seats—the navigator said "be sure and tell everyone the navigator finally got a seat that reclines." And while we're on the subject, the navigators will drool when they see this one. Among other things, there's an astro tracker, a Loran-C and Doppler. The desired flight path can be programmed into any one of these, the desired course maintained through the autopilot hookup and the navigator can monitor position and progress through continuous readout. Better get in your DR and Bellamy drift work while you can, fellas—you won't have much use for these in the '141. We wondered how good the radar was (it's iso-echo equipped) and asked if the navigator could provide GCA service. We were shown during a subsequent approach and were sold when the navigator pointed and

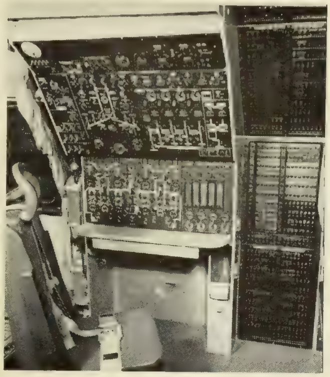
said, "See, there's the taxiway an
runup area; we can even tell th
pilot when he's over touch dow
point."

We were able to get a goo
impression of the engineer's statio
since we had three sergeant
aboard to work this position. On
had come from C-135's, one from C
133's and one from C-124's. "Ho
about the vertical instruments?" A
close as we came to an unenthus
astic reply was, "After 15 year
looking at round ones, these take
little getting used to." There's n
doubt that they can be scanne
more rapidly and quite accuratel
The panel seems rather austere fo
a big bird, then you rememb
there's no need for prop and mi
ture controls, and feathering bu
tons. It's doubtful if veteran C-12
and C-133 engineers will shed an
tears over the fact that they hav
no props to worry with.

Communications and navai
problems should be solved. Th
bird has dual VOR, UHF, AD
VHF, TACAN, DME and H
How about that! About where th
engineer sat in the '118 and '5
there's a big comfortable chair f
the third pilot and a complete set
radio controls. He can commun
cate with the airlift command pos
or anyone else as necessary, whi
the copilot is handling normal tra
fic control communications.

Now let's take a ride. Thi
doesn't involve much delay if t
clearance comes through on tim
There's no long runup in this bird
none at all, really. The checklis
can be run by the time No.

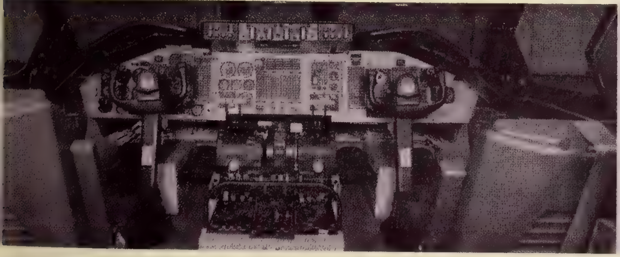
position is reached. After a momentary power check pause in lineup, we're on our way. With no cargo and just under 80,000 pounds of fuel this bird really moves out. Power, obviously, is ample. Nose steering is conventional (rudder pedal steering to be added later) with rudder control coming in well under 100 knots. Rotation, this flight, is 115 knots, and as climb attitude is reached, we're airborne. Climbing now, and accelerating, it's gear up and flaps up at 160. Hold it until 280 knots indicated, then raise the nose to hold four-engine climb speed. It's smooth! Old Shaky, you're through! The sound you hear is a "rushing air" sound. Faintly, as an undertone, the whine of the four big jets reaches the flight deck. We can converse without headsets if necessary, but with the handy interphone switches we use radio. The centrally located, realistic attitude indicator gets a lot of attention. Out on the nose like this, the pilot simply must fly with frequent instrument reference. You've heard of the vertical scale flight instruments (VSFI)—they're great! The altimeter gives a direct reading. This eliminates the 10,000-foot error. The airspeed tape has a white triangle at the 200-knot point. This triangle can be seen at all speeds between 100 and 300 knots. Somebody came up with a winner here. You'd really have to work at it to misread your air speed. Both altimeter and airspeed have another handy "extra" that has strong safety implications. This is officially known as the command marker, but in pilot's jargon will probably be referred to as the "bug." Suppose minimums are 1200 feet. Hold the command marker switch until 1200 appears. Have the copilot set his 100 above, at 1300, if you want. Then compute your approach speed—let's say it's 131—set the airspeed bug (excuse, command marker) at 131. Now you have set a double barred pointer at the selected altitudes and airspeeds. Hold the airspeed in the marker. When the altitude marker moves down to the indice you're at minimums.


C-124, C-133 and C-135A engineers agreed that the panel on the C-141 is one of the best yet. Close location in relation to cockpit windows permits the engineer to aid in scanning. Photo is of mockup; aircraft panels differ slightly.

Of course, there are other vertical tape instruments — EPR, N_1 RPM, N_2 RPM, EGT and FF are lined up in this order on the center panel. The pilots are enthusiastic about these.

Quickly, some other goodies. Right in front of each pilot is a master caution light. When this flashes on look over at the banks of lights on the annunciator panel. Now you're told, specifically, what's wrong. Low oil quantity, No. 4. Actually this happens to us, so a precautionary shutdown is in order. Once the checklist is completed (and it's a lot simpler than prop jobs), George Mizell gets in the left seat and decides to head for home. He chooses to cruise at 20,000 instead of 10, so up we go, 1500 feet per minute, 96 per cent, 260 indicated on three engines. This bird has power! In fact, during landing practice power has to be reduced to below horn and light settings to not exceed pattern speeds. One of the frequent jobs for the copilot is to hit the horn silencer button. He can't turn off the light in the wheel shaped gear handle. (Please, never hide this light under a paper cup. This was tried a few years back and a C-124 landed sans gear.)

Landing attitude will probably seem nose low—actually, the object is to touch down with the nose just inches off the runway, then ease it


Mockup shows excellent flight deck layout. Flight crews are enthusiastic about such features as visibility, vertical tape instruments, white lighting and communications.

SHAKY'S SUCCESSOR

continued

on. Remember, you sit much lower than in a C-124, even lower than in a C-135, C-118 or C-54. Reversing is accomplished by raising the throttles and coming on back. It feels similar to a recip during reverse, and reversing is most effective immediately after the nose is lowered. Simultaneous braking is SOP if you are shooting for minimum ground run. Brakes are metered anti-skid.

Safety aspects? We mentioned the excellent instrumentation. White lighting will be a real boon to tired old MATSmen's eyes. Every instrument is individually lighted. There is no glare or fussiness and chart and map reading is much easier. You could say systems are resplendent with redundancy. For example, there are three separate hydraulic systems.

All controls are power boosted and feel is generally comparable to any transport aircraft. The yaw damper takes a little getting used to. It sort of wants to push the rudder back against your foot as you start a turn. Presently, crosswind component is 15 knots—a little low for Travis, Lajes and some other favorite MATS stops. The rudder steering mod is expected to help. And maybe "Rube Goldberg" will revise his sun visor so that it can be slid around the track, not have to be unclamped and reclamped (a two-handed operation) with every change in direction.

Magazine space limitations require that we cut this flight short now. That's right, there's no popping in your ears. The cabin altitude was 1200 feet when we were at 29,000. And there were no pressurization surges. That's another thing that will help reduce fatigue on the long MATS missions.

There's more, much more — enough to make a book. In fact, there is a book, the C-141 Dash One. Let's hope it's the one you'll soon be using.

You'll enjoy it. ☆

Is the NAVAID "Out UFN"?

Maj Robert C. Adkins, Directorate of Flight Facilities,
Central Communications Region, Tinker AFB, Oklahoma

Are you part of the 10 per cent who "don't get the word?" By "the word" we mean NOTAMs. The AF NOTAM System is designed to give everyone concerned the word and in a minimum period of time if, and we repeat, *if* those responsible do their job.

Here, quickly, is how it works. The system starts with the guy in the tower or RAPCON who detects a NAVAID malfunction by a monitor alarm or pilot report. He normally advises Base Operations which has the responsibility for sending the NOTAM. The Base Ops troop prepares the NOTAM in proper format and gives it to the local weather office, which in turn, fires it off to the Tinker Central NOTAM Facility via the Operations Weather Support (OWS) circuit. At Tinker, the NOTAM is edited and transmitted back to all of you (we hope) through the same OWS circuit to each base weather station. The base weather attendant gives the new NOTAM to the Ops dispatcher, who, in turn posts it to his NOTAM board. The whole sequence should take about 30 minutes. Every 12 hours a complete new summary is sent out.

Like we said, this is the way it is supposed to work; however, now and then it happens—a NOTAM is not received or posted in time to be used.

What can we do about it? Plenty—as pilots, we should check the Enroute Supplement and the NOTAM board. By the way, read the small print in the Enroute Supplement. You might find "ILS-O/S UFN." This, of course, means no ILS at that base. The NOTAM summary should be "clean" for only a short time after the transmission times of 0900Z and 2100Z. Soon after being posted, the summary should start collecting changes—new NOTAM's or line-outs as cancelled NOTAM's. If you note, as I have on occasion, that no changes have been made for a period of several hours since being posted, you can bet someone is not doing his job. Go to the Base Ops dispatch desk and *ask.*

As for others connected with the system—keep the NOTAM moving. Don't wait to see if the equipment will be fixed in an hour or so. AFM 55-13 says a NOTAM will be sent WHEN there has been an interruption, etc. Weather people should realize that NOTAM's can mean "go" or "no go" for pilots and for that reason have direct influence on whether a mission can be flown.

Base Ops bears the brunt of responsibility. AFM 55-13 require them to review and update the NOTAM summary at least once *each* hour. They must make sure that each NOTAM that concern their own base has been posted and is *accurate.*

It's up to all of us: pilots, Operations, Weather, ATC controller and the Central NOTAM Facility to make sure this system works. It' a good system, but like most, n better than its weakest link. Don let that link be you. ☆

MISSILANEA

AMMONIA CONTAMINATION – An AGM-28 mated to a B-52 had just returned from a mission when the ground crew noticed massive ammonia discoloration on the missile body and lower portion of the pylon. The missile was washed down, then downloaded and taken to the maintenance hangar for further inspection and decontamination. When the forward body was removed, ammonia corrosion was found throughout the forward pressurized and warhead compartments. An ammonia leak check was performed in accordance with T.O. 21M-AGM-28B-2-9, but did not reveal a leak in the system. The ammonia bottle was weight checked and found to be 15 pounds light. The bottle was pressurized with nitrogen and the filter valve was submerged in water. This check revealed a leak at the "B" nut between the filter valve and the ammonia bottle. Further investigation disclosed that the "B" nut was loose. Removal of the union between the manual valve and the ammonia bottle revealed that a teflon ring was missing. In addition, the "B" nut was not the required nut as shown in the parts breakdown; use of the incorrect nut prevented installation of a teflon ring (Ref T.O. 21M-AGM-28A-4-1, Fig 95, Index 9 and 10).

This is the second incident of this type reported in a two-months period and in both incidents the missiles were returned to the depot for extensive maintenance.

OCAMA has recommended that "O" rings be updated to the latest configuration in accordance with T.O. 21M-AGM-28A-4-1, dated 1 March 1964, changed 1 June 1964, Fig 95, Index 9-10-11, at the next maintenance servicing of the ammonia beam bottle.

Major E. D. Jenkins
Directorate of Aerospace Safety

HAZARD ANALYSIS –A TWO-WAY STREET– "Too many, and I'll never submit another!"

This answer caught the safety officer off guard, especially since it came from one of the most experienced and respected technicians. It had been an innocuous question–"How many AFTO 22's (T.O. System Publications Deficiency Report) have you submitted?"

The missile safety officer recovered from his surprise and asked, "Why do you feel that way?"

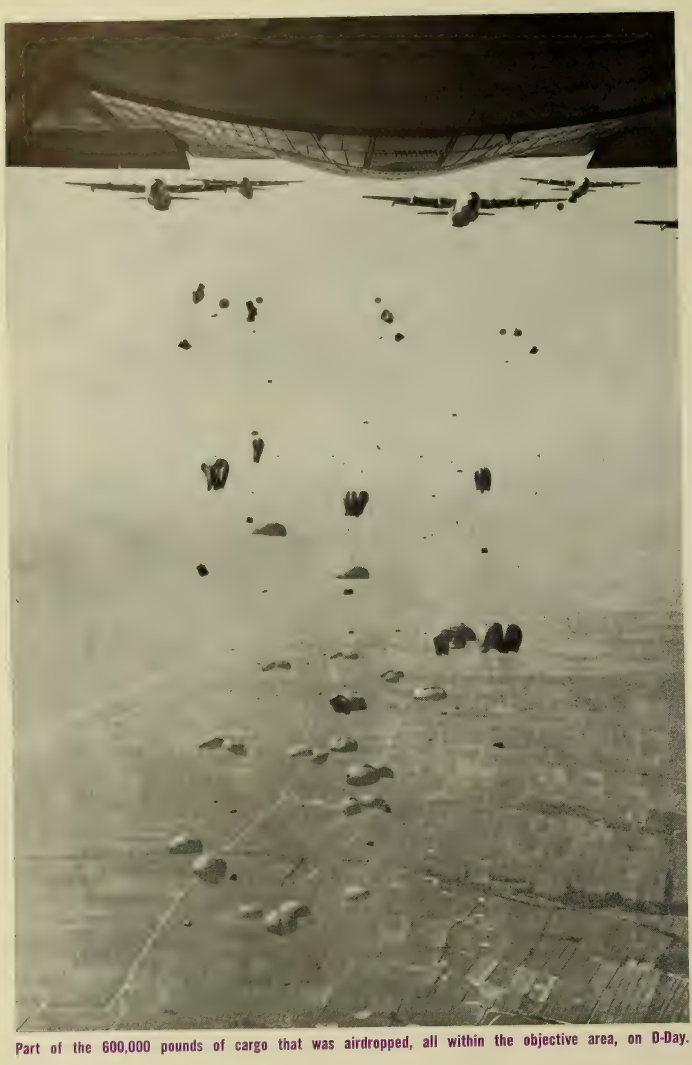
The technician explained that he had submitted a large number of reports during his missile experience and only a very few had been accepted. The great majority of the forms were never heard of again. He had experienced innumerable and repeated frustrations by receiving only a few of the forms back and these with the notation "Disapproved" without any reason for their rejection. After all, he said, he had devoted a great deal of time and effort to the submission of these forms and should have had at the very least something more than the word "Disapproved."

The safety officer explained that the value of a hazard analysis program, such as AFTO 22's and hazard reports must depend on the professional knowledge, application, and especially the favorable attitude of each individual. These programs cannot succeed otherwise. And hazards ignored, or at best tolerated, can later trip an unwary and innocent individual.

Actually, the correction of this condition is a simple one. It requires only that each reviewing agency take the time to inform each sender of the disposition of the reported hazard and give an explanation for those that are rejected. In this way the submitter will know what additional action he may take to resolve what is, to him at least, an important problem. It provides a personal incentive–he is told that his ideas are being given just and full consideration.

It is not enough to expect full and enthusiastic support at the working level without also expecting the same support at the supervision and management level. The hazard analysis program can undoubtedly be more productive as a result of making people at the working level feel that their efforts are worthwhile. This is the two-way street; to be effective, communication must travel both ways. ☆

Major K. H. Hinchman
Directorate of Aerospace Safety



Part of the 600,000 pounds of cargo that was airdropped, all within the objective area, on D-Day.

Mission planning: that important first step in accident-free operation.

SKY
SOL

Split-second timing o
to be successful. Na

TIEN BING VI

DIER

The pictures on these pages show typical action as, last fall, over 70 USAF aircraft, under operational control of the 315 Air Division, air dropped and air landed more than 3800 personnel and over 3,800,000 pounds of cargo in the United States-Republic of China Exercise on Formosa. Pacific based aircraft were massed in Okinawa for the start of the exercise which was climaxed with airdrops and landings in the exercise area on Formosa. Using the 463L roller system, C-130's were off loaded in less than 10 minutes. Air dropped cargo using this system exited the aircraft in less than 10 seconds. The exercise was designed to improve the combat readiness of participating units, exercise the airborne capabilities of the U.S. Airborne Brigade; evaluate the effectiveness of marshaling plans, procedures and techniques, and provide training in all phases of combat airlift and tactical air operations.

Brig Gen Richard H. Ellis, Troop Carrier and 315 Air Div commander, briefs loadmasters.

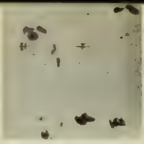
Using the 463L roller conveyor system, crews onload and offload cargo in minutes, airdrop cargo in less than 10 seconds.

Sharp-eyed maintenance men are vital for safe mission accomplishment.

mandatory if mission is 35th TCSq plan mission.

ind support must be the best. SSgt R. Wing, of the 51st OMSq., refuels.

SKY SOLDIER

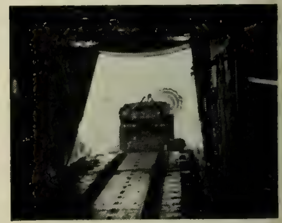


Capt John A. Dale, aircraft commander, briefs his crew.

5 a.m., Capt. Harold L. Hale and 1/Lt Frederic L. Riggle check final items before starting their C-124 engines.

C-124's of MATS' 1502d Air Transport Wing line up for takeoff.

A scanner's eye view as C-130's fly formation en route to drop zone.



An Army vehicle is blurred by its lightning exit from a C-130 of the 315 Air Division.

The mark of success: On time, on target, and without accident.

THE CHANCE TAKERS

Like adventure? Suppose you had been looking over the pilot's shoulder on this one.

Approach Control contact was established early in the penetration, descent made to 4000 feet and handoff to GCA. Windshear makes frequent heading changes necessary. It's rough, too. Pull the harness tighter and hang on. Near minimums—still not aligned. The pilot adds power, pulls the nose up and starts a missed approach. Around the GCA pattern to line up again for a full stop landing. Again runway alignment is off at minimums. Power . . . nose up . . . missed approach. Weather worsens during the circuit for the third try. Visibility is down to two miles in rain and fog. Wind continues to be cross, gusting to 20 knots. GCA advises loss of target at four miles and cautions not to descend below 500 feet. Target picked up again at two and one-half miles. Too far left. Go around. Again power . . . nose up. Slant range viz is zilch. "Can't see the runway at one mile," the pilot says. He checks the fuel. "Request short pattern." You're for that.

You hear the supervisor of flying's suggestion to change runways. GCA says it will take 20 minutes to set up their equipment on the other runway. Another look at the fuel gages. The pilot turns the suggestion down and continues his left turn to try again. Pattern is short and glide slope is intercepted at five miles. Good azimuth on the GCA scope, but no elevation.

At four miles GCA instructs, "Start descent." You're 200 feet left of course. At three miles GCA picks up intermittent reception on the elevation and advises 20 feet low. Left to right drift is carrying you across center line. At one and one-half miles, still intermittent elevation reception, aircraft is 100 feet right. Large azimuth corrections to the left are given. At one mile GCA advises go around if runway not in sight.

Visual contact now. Too far right. Left turn . . . low . . . power. THUMP. On the left side. Climbing out again. There's a warning. No. 1 generator.

A minute later, low oil pressure, No. 1. The pilot doesn't shut it down. He wants that engine, if at all possible, because of the crosswind. He asks for an ILS to a different runway. Cleared.

During turn to base leg for ILS approach, No. 1 seizes. He declares emergency fuel and an engine out. ILS not working properly (the "thump" was the aircraft striking the ILS antenna on the previous missed approach). GCA headings to the runway are being given on Guard. At one and one-half miles a streak of light ahead and below. The strobe lights! There's the runway. Touchdown! Aircraft starts to right. Full aileron and rudder. Stops on the right edge. Everybody's had it. The pilot shuts down right there.

Well, from over the pilot's shoulder it has been exciting. Now that you're down and safe you feel better about it. But for a while there your mental urging was to go to the alternate.

The analysts had an explanation. Striking the ILS antenna was due to a severe crab and heading changes the pilot was unable to follow at the last minute. And when he went visual the heavy rain obscured the lower part of the windshield. This prevented his sighting the strobe light, therefore he was unable to determine his correct altitude at a very critical moment. During this fraction of a second the aircraft got too low, striking the antenna. Also, they contended, GCA should not have cleared the aircraft to descend without elevation information unless they advised the pilot of altitude vs. distance during the approach. Further, the pilot should not have descended without either GCA elevation or surveillance.

Recommendations included: better radar to present isolated precipitation patterns, improved airport approach lightning to include roll bars and VASI lights and wider runways.

This case was another in a series that illustrates the risk in attempting approaches and landings in marginal weather. Here are a few others.

A transport hit a TACAN facility during an attempted approach with a thunderstorm over the field and a ceiling obscuration due to rain.

A fighter made repeated missed approaches in a thunderstorm area and finally the pilot ejected when fuel was exhausted.

A jet bomber touched down in a field short of the airport, became airborne, took out a power line, then made it to an alternate.

"History Repeats," August '64, "Kilo Confusion," November '63 and "Non Support of the Pilot," April '62, are other AEROSPACE SAFETY magazine articles that illustrate the hazards of attempting to recover aircraft in marginal weather.

Now let's stop beating around the bush. If mishaps such as these are going to be prevented we have got to take the safe route. If we continue to operate as we have in the past (and apparently we are), then let's accept such mishaps as the occasional price that must be paid for known risks. But if we want to prevent accidents let's look at the problem objectively:

We know that heavy precipitation blots out aircraft returns on controllers' scopes.

We know that rain removal systems are inadequate in heavy precipitation.

We know that approach lighting is inadequate at many bases (the system is shown on every approach plate).

We know that the coefficient of friction is much less on wet and icy runways.

We know the length and width of all runways (every approach plate also gives this information).

We know that weather moves, and that conditions often improve if we hold a few minutes.

We know that "legal" minimums aren't necessarily safe minimums, especially when associated with heavy precipitation, crosswinds, turbulence, darkness, lightning, icing conditions, approach zone obstructions, cliffs, sea walls . . . or any other condition that can make an aircraft approach more hazardous.

So . . . why do we have mishaps such as the one recounted at the beginning of this article? We have them because supervisors fail to carry out their responsibility and divert aircraft to suitable alternates. We have them because these supervisors make decisions on the basis of operational convenience rather than safety. As long as approaches are "legal" they are in the clear.

So long as this concept of operation continues we can continue to write articles to illustrate the hazards. They will do no good.

So long as the chance taking supervisors at all levels fail to assume their moral obligation, air crews, passengers and aircraft will be lost during marginal weather approaches.

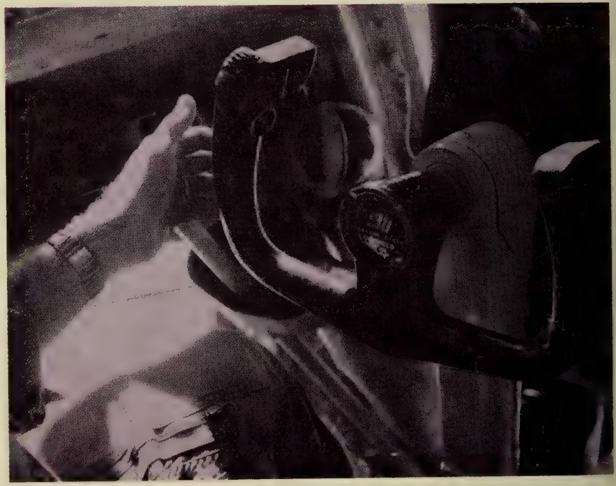
One more thing—pilots, if you have supervisors without the courage to make decisions, to send you to an alternate when safety dictates, exercise your prerogative and divert to a safe alternate. Remember, the supervisor *might* lose his job—you *can* lose your life. ☆

* * *

We repeat . . .

WHAT DOES IT TAKE?

In final analysis, safety of every flight must rest in the hands of the aircraft commander.



Capt John T. Taylor, Chief, Flight/Nuclear Safety Div.,
Robins Air Force Base, Georgia

Not so long ago, a transient aircraft with an uncontrollable propeller was diverted to another USAF base. To keep the RPM within limits, the pilot was forced to fly with partial flaps, maintaining an uncomfortably low airspeed. Work was in progress on their one and only runway at the home station; however, the runway was usable in the event of an aircraft emergency. Basically, all that was required was that Flight Operations clear all equipment from the runway until the distessed aircraft could be recovered.

The pilot in command of the aircraft was uncertain about his prerogatives under emegency conditions. The Operations type who ordered this aircraft to divert should also bone up on a few USAF Regulations. Here are some selected extracts:

AFR 60-16, 20 Nov 62.

Par 5. Command and Control of Aircraft:

a. The organization commander responsible for the flight will designate the pilot in command of the aircraft. This pilot, regardless of grade or pilot rating, commands all persons on board and is responsible for the safe operation of the aircraft.

Par. 8 Compliance With Air Traffic Control Procedures:

A pilot will comply with ATC procedures unless an emergency makes deviation necessary in the interest of safety.

Par 9. Distress:

a. An aircraft in distress has the right-of-way over all other air traffic.

Par 17. Landing and Takeoff:

b. Normally, landing and takeoff will be made on the runway most nearly aligned with the wind or as recommended by the airfield control tower. If, for reasons of safety, the pilot does not concur in the tower recommendations he may land or take off on any usable runway when cleared by the control tower for such landing or takeoff.

Par 59. Deviations From This Regulation. Deviations from this regulation may be made as follows:

a. At any time when an emergency or special circumstances exist . . .

AFR 60-22, 10 Apr 62.

Par. 8. Emergency Procedures:

In emergency situations requiring immediate decisions and action for the safety of the flight, the pilot in command of the aircraft may deviate from the provisions of this regulation to the extent required for such emergency.

AFR 60-23, 26 Jul 62.

Par 5.

b. When an aircraft experiencing an inflight emergency is approaching the airfield to land, all takeoff, landing, and taxi operations, except emergency operations (crash rescue vehicles, etc.), will be discontinued and the traffic pattern will be cleared. When possible, such action should be taken in time to insure availability of the landing area to the approaching aircraft.

These are your prerogatives, pilots. Use them. If you're not willing to exercise your command authority as aircraft commander, move over—your replacement is waiting. (See AEROSPACE MAINTENANCE SAFETY Magazine, August 1964, page 10.) ☆

ANATOMY OF A GCA

Maj Roger B. Condit, 2031 Comm Sq, AFCS
Selfridge Air Force Base, Michigan

"That was the worst GCA I ever had!" remarked a thoroughly disgruntled pilot the other day. "When I broke out, I was lined up with the parking ramp and had to go around."

This was typical of several remarks made by pilots during a period when the elements were far from stable. The underlying connotation in all these remarks was that the GCA controller was the culprit.

One thing is certain. They truly were bad GCAs! If a pilot cannot land out of a GCA, it is a bad one. For that matter, *any* kind of an approach from which a landing cannot be made is a bad one. But let's examine these approaches. Let's look at the anatomy of a GCA.

First of all, let's establish who or what was *not* the culprit. It was not the controller. It was not the pilot. It was not an erratic electronic device that caused the wrong information to be given the pilot. What was it then?

It was turbulence! That's what it was!

A GCA is entirely different from any other approach in that a middleman — the GCA controller — feeds the information to a pilot which enables him to make adjustments to course and glide slope. (This is done electronically by other NAVAIDS.) Although the radar used on final approach of a GCA is precise to a high degree, there is a time lag created by the middleman. He cannot possibly transmit corrections to course and glide slope as rapidly as an electronic device, an ILS, for example, can indicate on a cockpit instrument.

A GCA is often compared to ballroom dancing, for to borrow the words from an old song, it "takes two to tango." One must lead and the other must follow. And if you get a couple out on the floor with a fair idea of the rudiments of the dance, they'll get by all right even if they don't qualify as Arthur Murray instructors.

Let's get back to anatomy again. There are three factors in a GCA—the pilot, the controller and the elements. If the first two of these know the rudiments of a GCA and the third is insignificant, there just wouldn't be a bad one. However, let's examine the third factor when it *is* significant. Here is the real culprit—turbulence.

If the controller gives the pilot a heading correction, but, because of turbulence, the pilot is unable to hold it; if several of these corrections are given but can't be held; if the aircraft is bouncing along the final approach like a yo-yo with a snarl in the string, then this makes for a loused up GCA! Certainly no pilot will claim to being able to hold his aircraft on a constant heading during turbulent air conditions. Add this to the fact that he is constantly being displaced vertically and horizontally and it can readily be seen why a GCA is a very difficult approach to accomplish successfully during these conditions.

All this can lead to one question that deserves an answer. As a pilot, you may ask, "How, then, do I safely get my bird on the ground?" The answer is not all inclusive since we recognize that there will be times when you will have no choice but to land under such conditions. However, if you have a choice, don't make an approach during turbulent conditions. Go to an alternate or if the condition is temporary and you have sufficient fuel to hold, wait for the condition to pass. Lastly, if you have the option of taking an ILS, take it, with GCA monitoring the approach! This NAVAID will indicate course and glide slope deviations more rapidly and eliminate the middleman. ☆

Last month, in the article "How Safe?", Major Mozley discussed Silo Safety Evaluation—the questions that must be answered, the actions necessary, the hazards involved in determining the condition of the accident site prior to allowing investigators to penetrate.

In this article the author follows up with advice on how to conduct a systematic, organized search for the accident cause.

Seeking the Golden Easter Egg

Maj Curtis N. Mozley

Directorate of Aerospace Safety

The silo safety evaluation has been made, the venting gases are under control, or in such a condition that work can be done around them, and the "purge" fan is operating. The Missile and Launch Complex Systems Group has the necessary equipment, and the early statements of witnesses have been obtained by the Launch Operations and Witness Group. With these preliminaries accomplished, the investigators, rather than embarking on a haphazard, random type search through rubble for answers, should now conduct a systematic, organized investigation.

Since past silo "blows" have not damaged the Launch Control rooms, it is recommended that this area be used as the silo investigation control area. Assuming that entry into the silo proper can be made from the Launch Control room via the normal entrance tunnel, use of the control room facility expedites the investigation. The base civil engineer is capable of providing electrical power into the Launch Control room. It is possible that a portable generator can tie into existing circuitry throughout the Launch Control area. Experience has proven that, in the main, the electrical equipment in the complex, other than the silo, has remained in usable condition, as have communication land lines. With a little civil engineering ingenuity, even the water systems can be made functional once more.

After electrical power has been restored, priority should be given immediately to land line communications between the Launch Control area and the base facility being utilized by the rest of the Accident Board. (All activities at the silo must continually be made known to the Coordinating Group Leader.) The Coordinating Group should give equipment requirements to the Base Contact Officer well in advance of programmed utilization time. The capability of immediate contact with other investigation groups at the base enhances the efforts of the "silo rats."

Intensive investigation of the destroyed silo generally can begin three or four days after the mishap. Placement of the purge unit into position on the cap as soon as possible after the fire has died out dictates the time, but normally, sustained investigative operation has been possible within the time period indicated. The use of a "sequence of events" diagram, provided by the Witness Interrogation Group from initial witness testimony, will channel first investigative efforts within the silo. By this time, the Witness Interrogation Group will have arrived at a plausible time sequence and derived from the launch crew/witness personnel possible cause factors and suspect malfunctioning systems. Taking this information, the Missile and Launch Complex Systems Group Leader should program his objectives. Considering the adverse working conditions within the silo, he should direct his team's investigative efforts into a systematic process of elimination. Of course, the most suspect missile/AGE system will be the first to be investigated. In conjunction with this effort, the next logical "suspect" should receive attention.

By proper division of the Group's personnel into system teams, strides toward the end objective can be made.

COMMUNICATION NEEDED

Communication within the silo is a safety requirement. The first trip into the silo and to the bottom levels will be for the placement of safety gear and field telephones. A minimum of four field telephones should be used. The locations may be varied, but one should be topside on the cap, one in the Launch Control area, and the other two within the silo. It is advisable to have a telephone close to the area where work is being concentrated. With all telephones interconnected, a system of signal rings can be arranged. When personnel are in the silo, the field telephones in the Launch Control area should be monitored. This doesn't necessarily mean that someone should listen all the time, but personnel should be available to answer the proper ring. When the crane is being used to lower personnel or equipment into the silo, the field telephone on the cap, as well as a field telephone in the silo, must be manned.

A minimum of two emergency breathing apparatus units should be placed on each of the bottom levels of the silo. Wood planking may be used across dangerous areas where floor grating has been blown or burned away. Extremely hazardous areas should be roped off or flagged.

No more than two teams should be working in the silo at one time. An officer should be in the Launch Control room at all times when personnel are in the silo. As one of his safety duties, he should maintain a log to monitor the location of personnel within the silo. Investigators in the silo must keep the silo coordinator advised by field telephone of their movements as well as progress.

Teams at lower levels are at a disadvantage. Bits of concrete may be kicked through the grating by work groups above. By the time these pieces fall a hundred or so feet and disturb other bits of concrete, the shower really thrills the receiving troops! It is amazing how big, brawny men can completely hide inside a hard hat until all the little bits of rock and debris have bounced off. Then they come out looking for somebody to punch in the nose! All movement in a destroyed silo has to be done "like on eggs." Safety belts and rope must be used while climbing, stepping across open areas, etc. Nothing is more needless or undesirable than an accident while investigating an accident.

CLUES AVAILABLE

Witness testimony, recorded console indications at time of accident, and knowledge from maintenance records will probably point to a specific subsystem as the prime suspect. A team of investigators should be assigned to thoroughly check and evaluate all portions of this system. The Atlas F LOX transfer system will be used for illustration.

First, insure that everything has been done to safeguard the working area, then completely check out the system. Don't make the mistake of leaping to early conclusions predicated on the discovery of a possible cause factor. For example, the discovery of a valve broken off its normal bracket might not be the cause but could later prove to be a result. Thoroughly investigate the system, from the storage tanks through the transfer system, and into the missile. Be sure to note and photograph any suspected abnormality. Take sufficient pictures, measure alignments, and use available technical advice prior to disassembling portions of a system. As much care should be taken in removing parts for topside scrutiny as was taken in the original installation. Ends left open after disassembly operations, as well as parts going topside, should be covered with pliofilm then taped. Identification tags should be wired on all removed parts, regardless of their size or seeming importance.

After a complete system or part of a system has been checked, efforts should be directed into allied or directly related systems until all possible cause factors have been eliminated.

In the interim period, the Accident Board Explosive Material and Fire Pattern Group joins the Launch Complex Group for their portion of in-silo investigation.

The Launch Operations and Witness Group and the Maintenance Inspection and Records Group continue to provide information throughout the course of the investigation and are available for obtaining, confirming, or refuting data for the Launch Complex Group. If a suspected item or system is coming to the foreground as a prime contender, all pertinent facts should be extracted from maintenance records to complete the package.

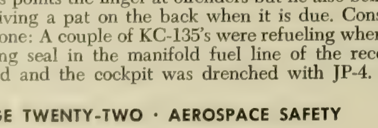
If all available leads seem to have been exhausted, it is possible to proceed by logic. Taking all KNOWNS into consideration, it is likely that a reason for the mishap can be determined. For example, in conjunction with the sequence of events it might be concluded that a particular event was caused by a specific system malfunction. The basis of this conclusion is the Accident Board's knowledge from confirmed and verified witness testimony that: (a) certain lights gave particular indications at a given time; (b) a piece of support equipment performed abnormally during the countdown; (c) detector alarms functioned or, conversely, didn't operate as they should have when they should have; (d) debris within the silo gives, or does not give, evidence of having been deformed by fire prior to or after the explosion. Investigating personnel should then direct their efforts toward either proving or disproving their theory.

The function of each subgroup of an Accident Investigation Board is to determine, then present to the voting members of the Board, their concept of what happened, how it happened and recommendations to preclude recurrence. The Board members must critically evaluate all presentations and agree by a majority vote that certain things did happen and were caused by a particular malfunction or error. Therefore, the group investigating in the silo has to be most thorough and complete in their presentation and opinion as to the cause of the mishap. They are the hardware experts and are expected to come up with the answer in most cases.

As a recap, the job in the silo is a dirty one. It is very tiring and dangerous climbing up, down, around, and through, but when the team finds the "Golden Easter Egg," it is most gratifying. The recommendations your Board makes may prevent future silo blows and save lives as well as a valuable silo-missile complex. ☆

Rex Riley's CROSS COUNTRY NOTES

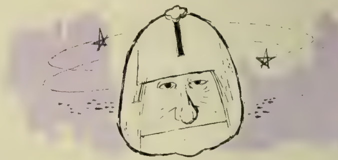
AH, C'MON HORSE, WHOA! Rex was reminded of the cartoon of the rider desperately hauling on the reins as his horse went over the cliff when he heard about this C-46 driver. Seems he felt the left brake pedal becoming squishy right after he turned into the parking ramp area. A quick check of the brake hydraulic gage confirmed what the left foot suspected—the pressure was falling rapidly. The flight engineer immediately began actuating the emergency hand pump. No luck. Since the aircraft, in which the crew had now become passengers, was heading directly for a parked C-130, the pilot applied left throttle and started a wide circle. The C-130 was missed and, after a three sixty, the airplane being in a relatively clear area, the pilot tried to continue his circling as a means of getting the thing stopped. But, as the transport slowed it began to straighten out and line up nose to nose with a KB-50. This time distance did not permit the out turning maneuver, so they cut the switches and waited. Collision with the KB-50 stopped the errant C-46. Looks like these troops did their best under the circumstances. Some aircraft have more emergency stopping facilities than the C-46 and all pilots should know how to quickly use air brakes, reversing and whatever other aids they may have available.



KUDOS TO REFUELING CREWS! Rex sometimes points the finger at offenders but he also believes in giving a pat on the back when it is due. Consider this one: A couple of KC-135's were refueling when the O-ring seal in the manifold fuel line of the receiver failed and the cockpit was drenched with JP-4. This crew acted fast. They disconnected, turned off all electrical equipment, went to 100 per cent oxygen and started an emergency descent.

The crew compartment was a mess, insulation and floor padding saturated, heavy fumes. The other airplane followed them down, then took the lead so that the receiver could follow. Lead made radio contact and led the receiver into a safe landing. After the aircraft had been abandoned by the crew and isolated, 20 - 30 gallons of fuel were found in the lower compartment.

Both crews deserve a Well Done.



HOW AN OHR CAN HELP. When things have gone wrong there are several actions the victim can take. He can tell his tale of woe at Happy Hour, or to the little woman, or his secretary—these actions tend to relieve the pent up feeling, but otherwise are ineffective. In the military there are means whereby the get-it-off-the-chest urge can be satisfied AND some good may be done as well. One of these is the OHR. Here's an example. A pilot had flown from the southwest to near his eastcoast destination, then began to get the "confused assist" treatment. Seems some of the info on his 175 hadn't been passed—he wanted to land at the Podunk Navy field, not the Podunk Municipal, and his bird was TACAN only. Trouble started when a helpful soul advised that his destination had only 5000 feet of paving. The pilot then tried for a nearby Air Force base. They didn't want him—official business only. He was cleared to a TACAN which he couldn't pick up—it was out but neither the pilot nor the controller had the NOTAM'd info to this effect. Then the controller's radar faded, fuel was low, positive identification was lost, the pilot noted he was off the coast and headed east, made a 180, squawked emergency, headed back for a pair of runways he had spotted earlier, was given steers and made a safe landing.

This one (Rex didn't go into all the details) fits all the requirements for the ineffective Happy Hour treatment. But this boy took the time and trouble to fill in all the details in an OHR. As a result, a complete investigation was made and action taken to plug the holes in the system.

A bonus result, and Rex quotes, "The incident had been referred to the Center's Training Department and the subject matter, with all the indicated deficiencies, has been included in controller training courses and crew briefings." ☆

FAA ADVISORY

Bob Terneuzen, FAA Liaison Officer
Directorate of Aerospace Safety

ARE YOU PAINTING ME?

During the past several months numerous letters have been received from USAF pilots requesting information concerning the different types of radar equipment used in the air traffic control business and how these systems are used. Let's look at this equipment.

Primary radar (also referred to as search radar or skin paint) is that system used to provide service wherein no cooperative radar equipment, i.e., radar beacon or transponder is required aboard the aircraft. Many factors, such as aircraft speed, direction of flight, altitude or type of aircraft limit the usable range of primary radar. Narrow silhouette aircraft (T-33, F-100, etc.) usually present poor target returns to a controller through the primary system. Identification of an aircraft with this system is limited to either cooperative maneuvers by the aircraft when requested by the controller or position reports given by the pilot when over identifiable fixes appearing on the controller's radar display. On the other hand, it has the advantage of not requiring special equipment aboard the aircraft and can be used within its limitations by any pilot having two-way radio.

It is through the use of the Primary system that the controller is able to identify areas of precipitation and thunderstorm activity. As you know, through reading our previous articles concerning weather observed on radar, the controller can never be sure that he is identifying all areas of adverse weather.

A secondary surveillance radar system, more commonly referred to as Radar Beacon, is usually associated with the Primary radar system. This system, when installed, may be operated independently of the primary radar, or in conjunction with it. It requires that the aircraft be equipped with a "transponder" which is triggered by the ground equipment and replies on a selected aircraft code. The advantages of the radar beacon system are that usable range is greater; radar reflectivity of the aircraft does not affect the return, and by use of selected codes, or the "IDENT" feature of the aircraft transponder, radar identification can be established without requiring maneuvers of the aircraft or detailed position reports by the pilot.

In today's system, the low altitude controller (usually below FL 240) will use radar information from both of the above systems simultaneously. This is necessary because he controls aircraft that may or may not be equipped with a transponder. The high altitude controller (generally above FL 240 and Area Positive Control Airspace), on the other hand, normally uses radar information from the radar beacon system alone. This is possible because aircraft operating in this airspace are required by regulation to be equipped with a functioning transponder and the controller can avoid displaying the many unnecessary aircraft targets that would be received through the Primary radar system. Primary radar will normally be available, however, to be used by the high altitude controller to supplement his radar beacon information (to the extent that it does not derogate his display) when he needs it to provide weather data, information regarding chaff drops, and as a standby for radar beacon or transponder failure.

As most USAF pilots realize, each air route traffic control center utilizes more than one radar system. These radar systems generally appear at more than one control sector, within the center, and are arranged so as to form an overlapping picture that precludes the complete loss of radar services should one radar system fail. Regardless of this fact and of the reliability of the radar systems described, never become complacent to the degree that you find yourself entirely dependent upon the ground radar system to determine your position in space. Provide a secondary back-up system of your own through constant reference to other navigational aids. In addition, when relying on radar traffic information issued by a controller, remember that because of poor target quality some aircraft may not be showing a target return on the radar scope.

Keep alert and look around to stay alive! ☆

HEAR YE HELO HANDLERS

1/Lt Bruce S. Washburn, Det 23 Central ARC,
K. I. Sawyer Air Force Base, Michigan

Have you ever taken the front off a piano, you know the piece that holds the music on an upright model, and just sat there doodling around the keyboard, watching gadgets move? One fingered novice or virtuoso, it is simply fascinating to plink away at the keys, watching this little hammer strike that little wire, and listening to the ring of the notes. Try it sometime.

But in the meantime, what does tinkling the ivories have to do with that syncopated bumble bee called a helicopter? Just as the sweetness of the music depends on the skill of the artist and the tuning of the instrument, so the successful mission requires a proficient pilot and crew in a sound machine. Leaving the condition of the aircraft in the excellent hands of the maintenance men, let's emphasize a few pointers in the operational field where hitting a wrong note could raise unholy din and discord if things broke the wrong way.

First, let's consider indoctrination of the operational control commanders, many of whom have never set foot inside one of these gyrating machines. Down he comes to your operational section for an orientation ride to familiarize himself with chopper capabilities. Beware the pitfalls of overdoing it and casually wringing out the bird from redline to redline! If the man had any previous knowledge of helicopters he will probably be silently praying for his life as he watches the gages wind and unwind, and good old terra firma slowly but surely spin into orbit. Or, if he never rode the quivering creature, he will probably endure the ride bumpily and not so blissfully, and come away with some gross misconceptions about the machine and the "idiots" who fly them. Things that happen on the ride won't be forgotten and will be translated in all innocence into some weird mission requests at a future date. Give him a good background of sound information on the realistic capabilities of the helicopter, not some animated ideas of a Disneyland cartoon. As pilots, you should realize you will have to say "No" to a mission involving more than a little element of calculated risk. And the look of the eagles or stars can be mighty persuasive to the bars.

Remember, those not qualified as helo pilots can be expected to have a lot of misconceptions.

Watching a helicopter show on TV doesn't help. Civic minded councilmen and civic minded commanders could conceivably come up with some strange notions. It is perfectly obvious to any chopper pilot with an ounce of common sense and caution that a church steeple is no place to hang up a career if something goes wrong. Commemorating local history by hanging an eagle-shaped weathervane on the thing may be all right, provided the stunt isn't attempted using a chopper as the stepladder. There are many signposts along the way to make a professional helicopter pilot say "No" to the suggestion of such a preposterous mission.

Pilots should remember that investigation boards show no sympathy for prestige hunters. Rescue commanders stand behind pilots as far as they can, under the concept of the calculated risk, but the essence of this concept is that calculated risk is justifiable only on a life-saving mission. And, should a powerless bird slither down the steeple not even the calculated risk concept can be stretched enough to cushion that sudden stop.

A large amount of helicopter flying time is in direct support of the transport mission and the missions of the technical support services of Air Force Communications Service, Air Weather Service, Air Photographic and Charting Service and Air Rescue Service. With a substantial percentage of allocated flying time used up on actual missions, less time is spent on missions strictly for training. When the pressure of the actual mission with its rigid performance requirements is off, there is a temptation to relax standards of personal and aircrew discipline, as when flying around the flagpole. Don't succumb. Just because you are not out to pick up an ejected pilot from a snowbank, there is no reason to ease up and compromise in standards of aircrew discipline. The pocketbook is where it hurts the most, and there is no big umbrella of financial immunity if a bird gets bent while hedge-hopping or hover-buzzing on a training mission. Tomfoolery is hardly the intent of the operational leeway allowed a rescue crew commander in exercising his good judgment. If not for yourself, give your superior a break and make no compromises. He will be shaking in his boots right along with you if you roll one of those HH-43B Huskies or any other helicopter into a little magnesium ball.

Because so often the pilot is the only "on-scene" individual with the technical helicopter know-how, his responsibility is great. He must use good, mature judgment based on fact, never emotion, no matter how heavy the pressure. ☆

SNOW, SLUSH, DENT 81 AND POT 1

Have you ever heard a snowball build up? The following was overheard on UHF at about 0900 hours one wintery day. The players, in order of appearance are:

Dent 81 — the aircraft.
Pot Control — a command post.
Pot One — commander of the local unit.

"Pot Control, Dent 81, over."

"Dent 81, this is Pot Control, go ahead."

"Roger, Pot, Dent 81 is six zero southeast. Approach control advises you have 600 feet and one-half mile, with an RCR of five. We plan to divert to our alternate due to the condition of your runway. Over."

"Dent 81, Pot Control, stand by while we advise Pot One of your intentions."

(There followed a one or two minute pause.)

"Dent 81, Pot Control. Pot One advises that he is in his vehicle at the edge of the runway, and that the runway is not in as bad a condition as the RCR indicates. Over."

"Pot, Dent 81, we are rather heavy, about 5000 pounds under our max landing weight and the charts indicate a landing would be unsafe due to the excessive stopping distance. Over."

"Roger, stand by one."

(Another one or two minute pause.)

"Dent 81, Pot One advises that a C-130 just landed and encountered no difficulty. He reported the braking action was fair." (C-130's have four huge, reversible propellers.) "Pot One said he doesn't think you will have any problems and suggests you give it a try. Over."

"Pot Control, Dent 81, roger, we are four zero east and will make an approach. Out."

"Pot Control, out."

Now the radio is silent and we eavesdroppers go on about our chores. We look up just in time to see a most magnificent spectacle. Have you ever seen a big jet come whistling down a runway, spoilers up, snow and slush blowing out behind, rapidly running out of runway? A truly inspiring sight. Dent 81 came to rest on a graded area, on the centerline, about 200 feet off the runway. No real damage to the airplane, although I understand it required quite a few new tires. I believe Pot One will hesitate before recommending a pilot land when the flight manual indicates it would be unsafe.

Things can look a lot different from the driver's seat of an automobile at zero knots than they do from the driver's seat of an airplane at 130 knots.

In the winter things have a habit of snowballing. ☆

Aerobits

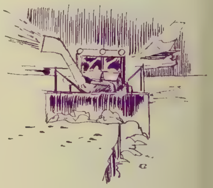
SNOW BANKS AND ICE CHUNKS—The co-pilot was taxiing the KC-97 from the left seat under supervision of the IP in the right seat. Moving down the ramp and heading for a taxiway, the right tiptank struck a snow drift, damaging the tank and allowing fuel to spill out. The taxi line and snow drift had been clearly marked with red dye marker, but due to a sudden thaw the dye marker had become obliterated.

And now for ice chunks—a twin jet. During flight at assigned altitude of 20,000 with no icing, no freezing precip nor snow forecast, the aircraft encountered moderate to heavy ice. A higher altitude was requested, but ATC was unable to grant the request. A short time later an attempt was made to vector the aircraft around the precipitation areas. In the process the aircraft was cleared to descend to 12,000. While passing through 16,000, structural ice dislodged and was ingested. Immediate flameout occurred on both engines. Restarts were successful and the aircraft was diverted to a nearby field where a successful landing was accomplished.

FUN IN THE SNOW. Every once in a while the fact that snow on the runway makes for longer takeoff ground runs is reproven. Early this winter it was done, in duplicate, by a couple of our multi-engine jets. The highly qualified instructor pilots planned their takeoff rolls at 8600 feet, critical field length as 10,700 feet. The first to go appeared to qualified observers to be considerably in excess of the planned 8600 feet. Next man's turn. For the second aircraft, a qualified observer stationed himself in a position to measure the unstick point. The second aircraft broke ground between 10,200 and 10,400 feet or 1600 to 1800 feet in excess of planned roll. Light snow was falling at the time, visibility reported as one and one-half miles.

Prior to these incidents snow had been cleared from both aircraft and, earlier, the runway had been plowed. At takeoff time it was estimated that loose, dry snow had accumulated to a depth of one inch, with isolated depths of two inches. Subsequent experimentation with the Dash One chart for snow covered runways disclosed that if the average depth were estimated to be 1.2 inches, and one-third of this was taken as the value for the loose, dry snow, the computed takeoff run of 8600 feet projects to 10,200 feet.

Some do, some don't. In previous "tests" aircraft have failed to make it and bashed off the far end. A little more snowplow exercise would seem to have been in order, especially before No. 2 ran his "test."

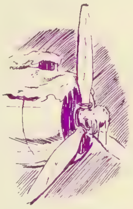


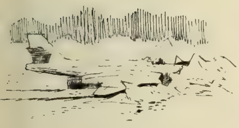
F-101 YA' BETTER BELIEVE. The left overheat light began flashing while the aircraft was on final of the fifth strafing pass. Throttle was retarded to idle and the light went out after about three seconds. The engine was operated at idle and the aircraft returned to base. On final, with the engine still at idle, the left overheat light came on again when the airspeed was decreasing through 200 knots. The left engine was shut down. The light went out. No further difficulties.

Cause: bad overheat connector.

ICED-UP GOON—Overseas, the C-47 departed a north country base en route to a middle Europe destination with a passenger stop en route. During the descent for the passenger stop, mixed clear and rime ice was observed to be building up on the wings. Carburetor heat and propeller deicing were used, but deicer boots were not operated. The aircraft remained on the ground for 20 minutes, during which time the engines were kept running. The aircraft was then cleared for takeoff.

Takeoff run was normal, but when the aircraft became airborne it began to roll to the left. Aileron and rudder were used, but were not effective. The throttles were then retarded. The left wingtip and left main wheel struck the ground to the left and at the far end of the runway. Both wheels then made contact with the ground and the pilot was able to keep the aircraft righted and roll across a grass area at a 45-degree angle to the runway. The aircraft was stopped with no further damage and inspected. The left wingtip had been damaged beyond repair and the outer aileron tip and hinge received minor damage. The pilots stated that there was ice on the leading edge of the left wing when they got out and inspected the aircraft. Weather at the time: Wind 13 knots directly down the runway, visibility two kilometers, light snow, 1500 scattered, 2000 overcast, temperature minus one, dewpoint minus one, altimeter 29.96.





GEAR UP BEFORE CLIMB ESTABLISHED-BELLY LANDING—Recently a pilot retracted the gear before a climb was established and the aircraft settled back to the runway for a belly landing.

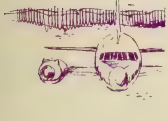
It has happened before, but this fact is no consolation to the pilot involved who was charged with pilot factor by the board, which could find no other possible explanation for the accident.

Possibly this type of accident will occur again. However, in the interest of prevention, all pilots should be reminded that unless a positive climb has been established, the gear should not be retracted.

The days of the "Hot Pilot" went "thataway" many years ago, but every now and then one still crops up.

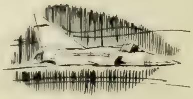
Lt Col Eugene J. Budnik
Directorate of Aerospace Safety

F-105 SHUDDER. On final for a low level bombing run at 560 knots the aircraft seemed to shudder. The pass was aborted and a climb initiated. Instruments were checked. No discrepancies. The aircraft was flown back to base. On post flight inspection the aft fairing on the right 450 gallon drop tank was found to be missing. The screw holes had elongated through continual airborne vibration allowing rivets to loosen and fall out.



T-29 DROP IN FUEL PRESSURE. The Dash One explains three ways of handling this problem in flight. Here are the symptoms and the solution as used by one crew. Climbing through 10,000 feet the right fuel pressure was noted at 19 psi. The booster pump was turned on. The pressure increased to 22.5 psi, then slowly fell to 22 psi. Approximately five minutes after level off at 11,500 feet the booster pump was turned off and pressure dropped to 17 psi. The fuel low pressure warning light did not illuminate and the engine continued to run smoothly. The propeller was feathered and a single engine landing made without further difficulty. Investigation revealed that the fuel balance line had been improperly torqued, causing a kink in the line that prevented proper pressure regulation with increased altitude.

Aerobits



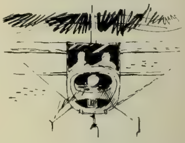
WEAK WINDSHIELD—A couple of pilots had a harrowing and painful experience when the left windshield of their TF-102 blew out during flight. The aircraft was straight and level at 40,000 feet with a cabin altitude of 18,000. Airspeed was .82 Mach. Suddenly the windshield failed causing explosive decompression and a cockpit full of flying glass. Both men received injuries.

The oxygen mask of the pilot in the left seat was blown off and he suffered hypoxia. Aircraft control was lost. The man in the right seat managed to regain control and place the mask over his partner in the left seat who recovered enough to assist in reattaching the mask. Noise, windblast and glass fragments made communications, control and seeing extremely difficult, especially for the night landing.

This crew got a lot of help from a wingman, GCI and Approach Control, which enabled the pilot in the right seat to make a successful landing. Later, both pilots' oxygen masks were declared unsafe for further use.

The windshield had been installed new just 29 days prior to this incident. However, about three weeks before it failed, the windshield had been struck by a bird while the aircraft was at low altitude, traveling at 250 KIAS. Following the birdstrike, the windshield had been cleaned and inspected with no damage found.

PIT STOP—The Cessna, with pilot and three passengers, landed after dark. Since the aero club runway and ramp were not lighted, the tower gave the pilot permission to land on the main runway and park on the ramp. The landing was routine and the pilot waited at an intersection for the Follow Me truck. When the truck arrived the pilot turned off the landing lights so that the driver would not be blinded. He then began to taxi toward the truck with lights out. When the Follow Me vehicle turned to direct the aircraft to the proper taxi route, the pilot turned on his lights and saw a refueling pit immediately in front of the aircraft. He tried to stop, cut the throttle and turned off all switches, but the aircraft ran into the curbing and base of the refueling pit. There were no injuries but there was extensive damage to the aircraft.



WHAT ELSE CAN GO WRONG?—A B-47 crew returning home in an aircraft that had just gone through modification had their hands full when:

- The forward main gear failed to retract fully.
- During recycle, the aft main failed to extend fully and had to be extended by the ELGE system. (Gear was left down for remainder of the flight.)
- Prior to takeoff at base where mod was made, fuel flow on engines 1, 2 and 3 dropped to zero but came up in about a minute. On runup prior to takeoff, No. 2 hung up at 65 per cent. This sort of thing continued throughout the flight along with an oil pressure indication of zero on one engine.
- No. 4 generator and No. 5 alternator went off the line.
- Weather deteriorated at home so aircraft diverted to another base.

After a visual gear check by a T-33 pilot, a GCA was made and the aircraft stopped on the runway to have downlocks installed. Then during taxi, No. 1 accelerated slowly and 2, 3, 5 and 6 would not respond to the throttle.

When Maintenance checked the aircraft it was found that a main gear circuit breaker was found to be popped and serious contamination had occurred in the main fuel tanks (metal particles, sand and fibre particles).

WELL DONE

MAJ RICHARD B. HUNT

CHIEF, FLIGHT OPERATIONS DIVISION, LOCKHEED AFPRO, PALMDALE, CALIFORNIA

Major Richard B. Hunt's performance in handling a double emergency in a TF-104G has earned him a Well Done.

On 17 March 1964 Major Hunt was flying a first Air Force acceptance flight in a TF-104G. While performing a specified test Major Hunt noted sluggish operation of the engine nozzle system. Upon subsequent throttle advance, the nozzles closed partially and then failed to the full open position, resulting in practically total loss of thrust. Major Hunt declared an emergency and proceeded toward Edwards AFB. After two unsuccessful afterburner light attempts, the emergency nozzle system was successfully activated and a routine precautionary landing pattern was entered at Palmdale. At approximately the low key point in the precautionary landing pattern, Major Hunt detected and correctly diagnosed an insidious failure of the airspeed indicating system wherein the airspeed began indicating approximately 100 knots higher than the correct airspeed.

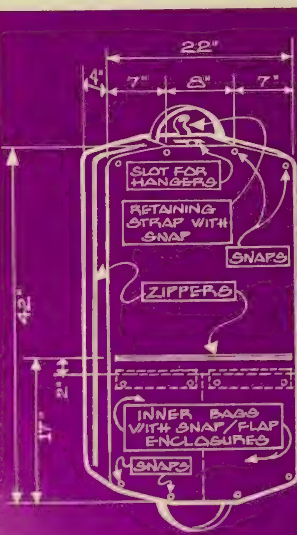
The precautionary pattern was continued by flying a combination of power and attitude. Major Hunt successfully touched down less than 1000 feet down the runway in a normal, slightly nose high attitude (the indicated airspeed was 295 knots at touchdown). The landing roll was completed normally and a turn off the runway was made at an estimated 15 to 20 miles per hour (indicated airspeed now 145 knots).

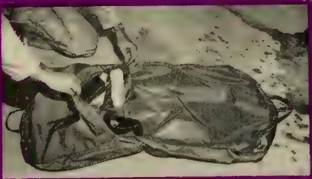
The cause of the first emergency was failure of the engine nozzle pump. Foreign material in the pitot-static lines caused the airspeed indicator to malfunction.

Major Hunt's skill and judgment reflect great credit upon himself and the United States Air Force. WELL DONE!

TRAVEL POD

Contributed by Capt Robert L. Giordano
1866 FCF, Hq AFCS, Scott AFB, Ill.


22"
4"
7"
8"
7"
SLOT FOR HANGERS
RETAINING STRAP WITH SNAP
SNAPS
ZIPPERS
42"
2"
17"
INNER BAGS WITH SNAP/FLAP ENCLOSURES
SNAPS


The clothing bag was designed by the Scott Air Force Base Fabric Shop for the 1866 Facility Checking Flight (AFCS). The outer pocket shown contains two smaller inner pockets with flaps and snap closures. These are handy for loose items such as shoes and folded shirts.

Short strap at top of bag snaps over reinforced slot for clothes hanger hooks. This effectively seals the opening and provides a retainer to keep hangers from dropping into the bag when carried by handles. Note full length heavy duty zipper along bag.

Bag is folded and four snaps are provided for securing the bag for easy carry by the handles at each end. Note clothes hanger hook retained by strap at reinforced slot. Material is sage [illegible]

Fiberboard panel designed to fit the floor of the T-33 baggage pod provides cut-out handle for easy pull out and loop for hooking clothing bag. Bags may be stowed folded with the first bag hooked leaving space for the sec- [illegible]

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

MARCH 1965

AEROSPACE
SAFETY

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AFRP 62-1 MARCH 1965 VOLUME 21 NUMBER 3

FALLOUT

RADIALS vs. MAGNETIC HEADING

(Quoted here are excerpts from letters to Colonel James G. Fussell, author of a letter titled "Radials vs. Magnetic Headings" which appeared in the January issue.)

I know you not, but God bless you and yours for a very succinct and accurate description of a situation that's been near and dear to my heart for a long time . . .

Col Archie M. Burke
Commander, Sioux City ADS
(SAGE) (ADC), Sioux City
Air Base, Iowa

—

Your letter, subject above, in January AEROSPACE SAFETY was outstanding. I agree with you completely. Most of the people I have flown with have trouble transposing the term radial into a reciprocal magnetic track. A phraseology like track inbound 247 degrees to the Podunk VOR would be a vast improvement . . .

Maj Charles G. Maynard
ACSC, AU, Maxwell AFB, Ala

—

Have just read your letter in Fallout (January 1964) and agree with you completely. In addition to the "gut gripers" you point out is the type who slips you a clearance change and asks for immediate acknowledgment while you are all elbows and eyeballs trying to locate the new route and hastily computing within 10 seconds if you can hack the new course. The different fixes and intersections are easily garbled and if you don't clutter the ether, you may find yourself in the "You can't get there from here" situation . . . Before I pass I will mention one more item and this is right in your back yard. Did you read the new feature "The IPIS Approach" on the next page to your article? As fine an example of military gobble-dy-gook written by a highly specialized professional on a subject which is a full-time job in itself, yet we mere desk-bound mortals are supposed to read and understand in our limited way what is easily understood by the author(s) of "IPIS." It does point up the need, and a terrifically crying need at that, for a complete revision of our instrument rules of flight to where they can be understood, remembered and practiced. (A prime example is your quoting the holding pattern entry—how many times has this procedure changed in the last seven years?)

Lt Col W. J. Amos
CAP-Great Lakes Region
Wright-Patterson AFB, Ohio

INVERTED AT ZERO FEET

Note your article "Wintersfullofhazards" in the November issue. The last sentence on page 19 of the section titled "Inverted at Zero Feet" is partially in error and should not be blamed entirely on Air Traffic Controllers.

The controllers should have relayed observed runway conditions and/or hazards, especially the centerline snow ridge stretching the full length of the runway.

After the first flight landed without mishap the flight leader's comment "Just about bought the farm," could mean nothing or several things. The pilot shouldn't have dropped it there.

continued on page 28

The accident prevented is rarely as spectacular as the one caused . . .

WHERE CREDIT IS DUE

When the fire goes out, restart attempts are unsuccessful, the pilot ejects and the bird is lost forever in 400 fathoms of ocean, or disintegrates in a smoking hole in a bean field, what really happened? Was it pure materiel failure, or was it possibly operator or maintenance induced? Did someone fail to lubricate a part because the fitting was difficult to see? Were improper stall clearing procedures used by the pilot? Had some previous pilots failed to write up the hot starts or overboosts?

Last year an engine blew up in flight, a fire resulted and finally the wing failed as the pilot dove his aircraft in an attempt to blow out the fire. The report carried the recommendation that the case be written up in AEROSPACE SAFETY magazine. Investigators contended that the accident may have stemmed initially from forced engine starts with a hydraulicked condition.

Here are a couple of examples from the December 1964 files. An airman, after having been told not to touch anything until the sergeant returned, attempted to duplicate an inflight malfunction. He managed to cause the gear to retract, letting the aircraft settle on a wingtip and engine nacelle. In another case a jet engine dome assembly separated from its attachment as the aircraft was climbing through 25,000 feet. Washers had not been installed, bolts could thus dig into the attaching plate, making grooves and weakening the plate to the extent that the dome assembly separated in flight.

The cases we've recalled serve to illustrate the fact that failures, because they can be so spectacular, are easier to recall than accomplishments.

Possibly, in the publicity glare of a few startling accidents the contribution of the vast majority of support personnel is overlooked. Let the maintenance man put in 20 years in the proper care and feeding of Air Force birds. Only with the highest personal standards of integrity, discipline and responsibility can men provide such service. However he is more likely to be remembered as a nameless "sarge" who inserts the chocks, holds the ladder, shows the pilot where to sign the services requests, stands fire guard on start and signals all clear for taxi.

A pilot who faces and solves an inflight emergency will often receive widespread recognition—maybe even a "Well Done" in this magazine. The maintenance specialist who sees a spot of hydraulic fluid on a line, takes the time to wipe it off, pressurize the system, find the leak, make repairs as spelled out in the tech order and then has the system tested and inspected is merely doing his usual good job. It is highly unlikely that anyone will come by and pat him on the back. But if he is careless, and if his supervision is lax, someday some pilot may have to eject and an aircraft may be lost.

Fortunately the vast majority of Air Force men know their jobs and can be counted upon to do them. This is of growing importance. Each new weapon system introduces new and frequently complicated components. These technological improvements add up to greater capability—and greater reliance on maintenance. ☆

Catching the barrier

ON THE APPROACH END

gives pilots one more safety tric

When a small group of engineers at Edwards Air Force Base complete the tests they are presently conducting, pilots of century series fighters will have a new item to add to their bag of tricks. This new trick is the approach-end barrier arrestment.

Arresting barriers are nothing new, but arrestment on the approach end is a little used technique that to the Air Force is new. Tests now being conducted were requested by the commands using century series aircraft, and it is anticipated that when they are complete there will be a handbook procedure for each of these aircraft.

The tests are being conducted in two phases, the first at Wright-Patterson Air Force Base, the second at Edwards. Phase One objectives are:

- Develop techniques for approach-end engagements.
- Determine the distance required to get the nose gear on the ground after main gear touchdown.
- Determine how near a pilot can land to a given point.
- Determine the distance required to become airborne after a missed barrier engagement.

Phase Two consists of tests of the procedures developed in Phase One.

Present plans do not call for the approach-end arrestment to be a routine procedure. Rather it is designed for known inflight emergencies such as a blown main gear tire, or an unsafe main gear. And it offers certain advantages over present barrier arrestment procedures. The primary advantage of the approach-end arrestment is that the barrier will maintain the directional control of the aircraft. Other advantages are a short ground run of approximately 1000 feet after the aircraft has hooked the cable, more precise placing of crash rescue crews because of the known stopping distance, time saving in foaming—only 1000 feet beyond the barrier needs to be foamed. In addition, if the aircraft misses the barrier, the situation is probably no worse than if the pilot had made no engagement attempt.

While tests are being made for all century series aircraft, as of this writing only the F-100 had been completed, and the F-102 and F-101 were in process. Consequently, the following conclusions and pilots' comments apply *only to the F-100.*

CONCLUSIONS

- Final approach and touchdown speeds should be about 10 knots faster than those recommended in the flight manual.
- The hook should be deployed prior to landing unless there are obstacles that could be engaged on a lower than normal approach. Hook deployment should then occur between the obstruction and touchdown.
- Main gear touchdown should occur approximately 450 feet in front of the barrier.
- When directional control is a problem, no attempt should be made to take off again.

Phase One tests consisted of a series of touch-and-go landings. A mark was placed on the runway for the desired main gear touchdown point. The pilot then varied approach and touchdown speeds to determine the optimum procedure for touching down as near as possible to the desired point on the runway. The nose gear was lowered in the shortest possible distance after main gear touchdown.

PILOT COMMENTS

Approaches varied from steep to extremely flat, drag-in approaches at different speeds. The tests disclosed that faster than normal approach and landing speeds offer several advantages: Aircraft control and handling characteristics improved; visibility over the nose and to the side is better due to the lower angle of attack; the reduced pitch angle required to rotate through, coupled with better pitch control and response, more than compensates for the increased speed to reduce the distance required to lower the nosewheel to the runway. Directional control, particularly rudder and aileron during the period from touchdown to engagement, improves with speed. Also, more margin is provided to insure against misjudgment, gusts, etc., which might result in premature touchdown in an unprepared area.

The 10-knot increase in approach and touchdown speeds is recommended for approach-end barrier engagements only and then only at reasonable gross weights where hook and barrier limits are not approached. A further increase in speed does not appear warranted. Normal approach angles are recommended. The two most significant points are accurate touchdown control and rapid preparation for engagement. The nose should be started down immediately on touchdown and retarded at the last moment with aft stick. Tests indicate that if the barrier were engaged with the nosewheel descending, just barely off the runway, but with aft stick coming in for smooth nosewheel impact, damage will be less probable than if the nose were slammed down.

The time between touchdown and engagement is very short—a couple of seconds—so the number of tasks to be performed during this interval should be kept to a minimum. Hence, hook deployment in flight! (There is less chance of hook-bounce if it is down before touchdown.) Speed brakes are optional but should be ignored after touchdown; wing flaps may be raised at touchdown. Raising the flaps is not considered necessary, but may reduce float, inadvertent bounce and help control the touchdown point. The stick should be held with the nosewheel steering button depressed for landing. Use of the drag chute is recommended just in case the hook misses the barrier.

Here is the ideal landing sequence revealed by the tests:

- Perform normal before-landing checks during slightly extended pattern. Lock and tighten shoulder harness.
- Deploy hook unless obstacles are present.
- Fly final approach at normal angle, 10 knots faster than Dash One figures.
- At predetermined point before intended touchdown, make normal flare and deceleration to touchdown speed (10 knots high), extend speed brakes if desired while throttle is retarded.
- Depress nosewheel steering button and move left hand to flap handle if flap retraction is desired.
- Immediately after touchdown, lower nose rapidly but do not slam it down. Simultaneously, deploy hook (if not previously deployed) and reach for drag chute handle. If serious directional problems warrant, the drag chute handle may be pulled as the nose is being lowered.
- Immediately after barrier engagement is positively determined, continue with barrier engagement procedure — steps 9, 10 and 11 (secure engine). Remember that, if barrier is missed, nosewheel steering may be a benefit during rollout and it may be necessary to delay securing the engine until leaving the runway becomes unavoidable.

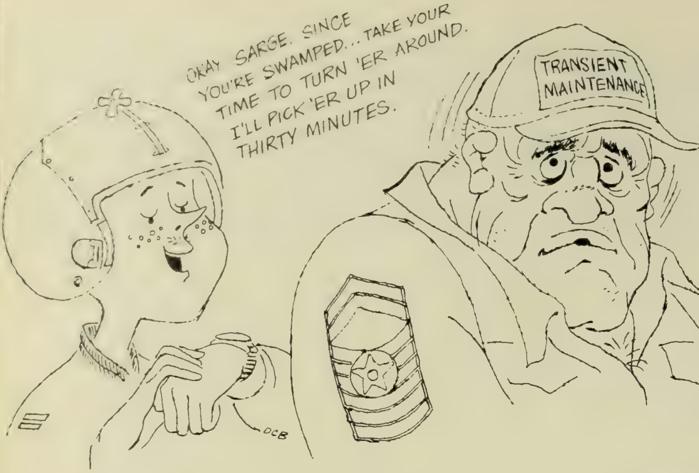
The essential steps are to land so as to lower the nose prior to engagement and to deploy the hook. All other steps are secondary but should be planned well in advance. Go-around after a missed engagement is not recommended for any but the most simple malfunctions such as known brake failure. Afterburner go-around is not recommended because of the rapid actions required at high speed where control is already difficult, the AB may light just prior to nosewheel lift-off which may cause difficulty in accomplishing accurate rotation, and the possibility of AB malfunction.

KEEP WEIGHT DOWN

Another important point to remember is that the approach-end arrestment should be attempted at the lowest possible weight. For some aircraft up to one-third of the aircraft weight can be disposed of by dropping stores. To lighten the aircraft, tanks, if not empty, should be dropped and stores jettisoned.

Normally, an approach-end arrestment, because it is an emergency procedure, can be planned and there will be time to plan for it. The pilot can burn off fuel and make some low approaches to get a feel for the impending landing. Ground crews can foam the runway beyond the barrier and place crash rescue units. If there is an MA-1A barrier it should be removed, and the flight test engineers are recommending that tire sections be inserted to replace the rubber doughnuts supporting the cable. Incidentally, these should be auto tire sections, not aircraft tires. Auto tires are soft and will not deflect the hook, whereas aircraft tire sections are extremely hard and the hook will bounce off of them.

This, then, briefly, is the approach-end arrestment. Experience to date has been encouraging. Of the nine actual emergency preplanned approach-end arrestments, only one resulted in major damage and two in minor damage. With the experience gained from the tests now being conducted, pilots will have a better understanding of this procedure and one more safety factor on their side of the scale. ☆


OKAY SARGE. SINCE YOU'RE SWAMPED... TAKE YOUR TIME TO TURN 'ER AROUND. I'LL PICK 'ER UP IN THIRTY MINUTES.
TRANSIENT MAINTENANCE
DCB

A transient maintenance specialist tells how pilots, too, can help the transient service situation in an article titled . . .

THE OTHER SIDE

By CMSgt L. Pitts, Transient Maintenance, Andrews AFB

In the past year, we've provided transient services for an average of 2150 aircraft per month. This included 55 different types and models. We're not experts on them all, but we have the ability to turn out a quality product on anything that comes our way. We're not interested in taking chances or cutting corners to get the job done. It's safety first, all the way. We never sacrifice quality for quantity.

Often our job is made more difficult by individuals who expect better service here than they can be afforded at their home base. Take the T-39 jockey who was in last week—his aircraft had a landing light out. A check of the forms indicated he'd had one on order back home for over a week, yet he was infuriated because we couldn't produce the same item in the six hours he was on the ground at Andrews.

Then there's the pilot who drives up, writes several discrepancies on the AFTO Form 781A, walks off, leaves no place of contact, then returns the next day to find his airplane still broke, or NORS, (not operationally ready, supply) and asks, "Why wasn't I notified?"

There are also the people who seldom read NOTAMS. Last May, we sent out a NOTAM, "Official Business, prior permission only." You guessed it, we had 146 aircraft arrive on the first day, an all-time record for transients, and 136 aircraft per day for the remaining two days of the NOTAM! It might be noted here that any one of these days represents more aircraft handled by the Transient Alert Branch of Andrews Air Force Base than are handled in an entire month by some of the bases which continue to be on the "Rex Recommends" list. We've seen the time when our parking areas were saturated to the point that we were forced to regretfully ask arriving aircrews to leave rather than RON.

You always have the pilot with a proposed 1400 departure, who gets highly indignant when told at 1600 hours that his aircraft has to be moved from in front of base operations because another Code must be in his parking place! The wasted manpower and tied-up equipment constitute an unnecessary drain on limited resources.

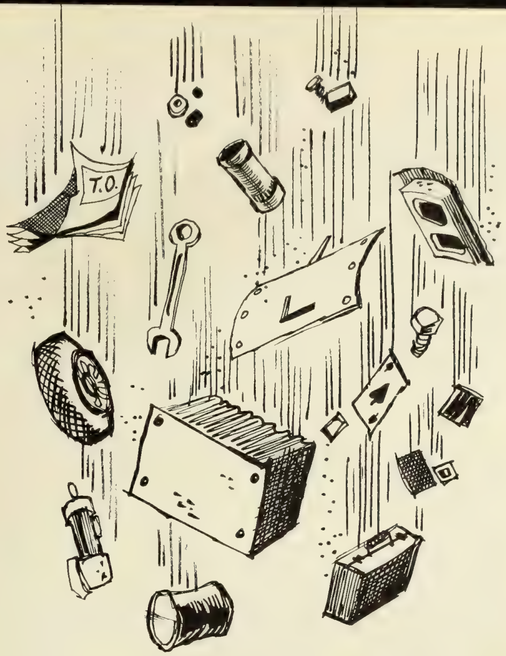
There was a T-29 in one morning with a double nose tire change. When the job was completed, the aircraft departed and returned the same day with two more old unserviceable nose tires that required replacement. So you can see, we're a supply depot too.

The best compliment we've ever had was in a Complaint Sheet turned in by a C-131 pilot who was disgusted because it took 66 minutes to change a main tire. This 66 minutes included the entire ground time from landing until takeoff. Could his home base do better?

Winter is here and we can well remember some of the incidents we were involved in last year. It costs lots of money to defrost an aircraft, yet some crews don't make their block time and the aircraft must be defrosted again. This doesn't sound like much but when you have an average of 30 RON aircraft per day, it adds up fast.

Our primary aim here at Andrews is to provide quality transient services in the most efficient, courteous and rapid manner possible. This is why we feel, Mr. Pilot, that the above-mentioned incidents, which are only a few of many, should be brought to your attention. We've been directly associated with transient maintenance for many years. We have observed transient operations on many bases. The problems here are no different from those at any other base except that they grow in proportion to the number of aircraft serviced.

The next time you visit any transient facility, remember some of the things we've mentioned. Be patient, make your block time, keep in contact, and above all, remember that you are only one of many. I'm sure with these things in mind, transiting will be more pleasant for you and every transient aircrew. Help others to help you and you will enjoy better transient services throughout the Air Force. ☆



LOOK OUT BELOW

Anything that becomes detached from a plane in flight will fall and falling objects create hazards. How much of a problem this is depends on several things: how much falls off, what it hits, and flight characteristics of aircraft after parts come off. Falling objects vary from such fragile items as people to virtually indestructible gear pins and, in size, from metal screws to wing sections. Sometimes these objects fall directly to the ground, occasionally they become entagled with the aircraft structure, at other times they merely flap in the slipstream to cause weird control experiences for the pilot. Here's what's been happening during the past few months:

C-130

During climbout the forward crew door blew open. An airman near the door was sucked out and fell to his death. The door hit the No. 1 and 2 props and damaged hydraulic lines. Through outstanding airmanship the crew was able to land the aircraft.

Inbound to a drop area a loadmaster untied a 450-pound parabundle and, when his attention was distracted for a moment, this bundle and one next to it rolled aft on the roller conveyors and fell out.

C-124

On takeoff roll the left life raft hatch fell to the runway. Loss was not noticed by the crew. A few minutes later, at 2500 feet, two "backfire" type noises were heard. Then a scanner reported loss of the left overhead, six-man life raft. Cause: Maintenance malpractice and supervisory factor in that the security of the life raft compartment door was not assured.

B-52

The left tip gear door was lost in flight. Cause: A cotter pin had worn which allowed the retainer pin to vibrate out. The unsecured forward hinge pin shifted rearward until the leading edge corner of the door dropped. Air pressures then forced the door off as the rear hinge shear bolt failed. The forward hinge pin, retainer pin and cotter pin were examined by the crew chief on walk-around preflight.

Both upper and lower engine cowling on one nacelle lost in flight. Probable cause: Air duct ruptured at takeoff, causing fire light to come on momentarily and at the same time blowing out the area on top of the nacelle. Subsequent wind pressure and oil canning caused the failure of the upper and lower cowling.

The navigator's hatch left the aircraft when turn was made over the IP.

At 16,000 feet an aircraft momentarily yawed and pitched as if passing through moderate turbulence. Post flight inspection showed minor skin damage and the ammunition access door to be missing.

At 16,000 feet, the navigator of another aircraft reported loss of the forward entry door.

C-133

Sometime between departure at Travis and arrival at Hickam the left life raft fillet and raft were lost from the aircraft. Possible improper installation.

F-100

During flight a sway brace from a drop tank pulled loose and was lost from the aircraft. Suspected cause factors: Insufficient design strength to withstand acceleration forces applied during close ground

support missions, possible installation damage (cross threading during installation, over-tightening of bolt), improper or lack of frequent inspection.

After 50 minutes of solo flight, another pilot reported that the drag chute and cable were missing. The pilot remembered a small jolt, but since he was passing a mountain range at the time he attributed it to be from turbulence. Most probable cause: Drag chute doors were not fully locked, with the locking mechanism not being in the overcenter locked position; vibration and pressure from the drag chute forced the latch open allowing the drag chute to jettison.

During Dart launch the cable broke. Cause: Cable wedged between cable strands causing backlash and snapping of the cable. Cure: Closer supervision of cable winding, particularly cross winding.

A pilot felt a "thump" during a check flight for correction of a gear malfunction which had caused loss of the left outer fairing door. Postflight revealed the door was again missing. Cause: Thought to be due to improper adjustment of the left main gear uplock mechanism allowing the outer fairing door to be exposed to the airstream.

A battery access panel separated in flight. Cause: Personnel error—preflight was conducted before daylight and pilot and crew chief failed to insure that the panel was properly installed and fastened.

KC-135

Shortly after rotation the pilot detected a lateral control problem requiring the application of five units of left rudder trim and approximately three units of left aileron to maintain level flight. After the mission, inspection revealed the upper wing beaver tail assembly was missing. Cause: Suspect fairing was not adequately secured after previous inspection.

F-84

Ground crewman pulled nose pin, but not main gear pins. Main gear would not retract. Pins fell out in flight.

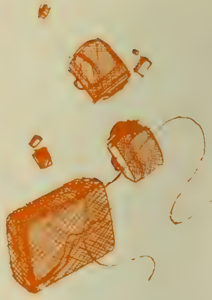
Three F-84's lost drag chutes in flight. Suspect: Drag chute assembly components, adjustment and wiring.

During climbout one rocket launcher and one rocket fell from lead aircraft. Suspect: bolt broke on rocket tube front pylon.

T-33

During climbout, passing 13,000, both tip tanks separated from the aircraft. The pilot had placed the tip tank jettison switch in the auto drop position prior to takeoff, but had failed to turn it off at 5000 feet. The wing tip switch on the right wing had failed internally and was shorting through the auto drop circuit. Failure of the switch erroneously indicated to the system that the right tip tank had separated from the aircraft. This caused the left tank to be jettisoned automatically. When the left tank separated the system functioned normally and the right tank jettisoned.

In another case tree tops were struck during an IFR departure. The strike occurred one mile from the runway, 100 feet above runway elevation. Impact ruptured the left tip tank and damaged the leading edge of the left wing. The copilot jettisoned the tip tanks.



Approximately two minutes after takeoff the inside aft section of the left tip tank fairing separated from the aircraft. This was the first flight following removal and replacement of the fairing.

F-104

The entire right wing outboard of the flap broke off soon after climb attitude was established. Cause: Structural failure.

B-47

When the bomb doors were opened for bomb release several articles being carried in the bomb bay fell out. Articles included two B-4 bags, one piece of molded luggage, one B-47 brake chute and emergency water rations. These articles had been secured with 1/8 inch cotton rope. (B-4 bags were recovered intact and virtually undamaged, molded luggage disintegrated and other items not found.)

A drop tank was lost in flight, cause not given.

F-105

On an air-ground rocketry mission the rocket launcher forward fitting loosened, allowing the launcher to swing toward the fuselage and when the rocket was fired it passed through the pylon, struck the fuselage and lodged inside an aircraft panel.

Less than 10 minutes after takeoff the pilot heard a sharp snapping sound and then a short duration airframe vibration. The pilot returned to home base, burned fuel down to landing weight and landed. Three access doors had separated in flight and FOD had occurred to the engine requiring an engine change.

B-66

At 1000 feet, 300 KIAS, the rudder pedals started a severe chatter and were oscillating approximately one-half travel. The pilot could not overpower them. Yawing occurred approximately one degree each side of center. Yaw oscillation was so rapid it resembled a severe vibration. Chatter and vibration stopped after five to ten seconds. Pilot tested the rudder pedals and could get full travel both directions without affect on the aircraft. Pilot was able to land, using differential throttle and aileron for directional control. The rudder was missing from the aircraft.

F-102

In four cases F-102's lost one or both pylon tanks in flight. Possible causes: Fitting failures, tanks not positively locked, excessive G's. Also, four access doors were lost. Possible causes: Failure to secure doors, inadequate preflight.

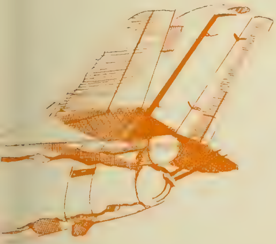
F-106

Pylon tank and pylons separated from aircraft during climb. Cause: Undetermined.

F-86

Tower reported a "bright, flaming object" fell from the aircraft just after it crossed the field boundary on a night takeoff. A precautionary landing was made and the missing part was discovered to be a part of the flame dome of the afterburner assembly. Cause: metal fatigue, cracking due to age.

After landing, a pilot noticed that a practice bomb had been dropped inadvertently. Cause: Cocking handle had blown back through the air channel of No. 2 bomb rack and rested on the manual release lever of this rack. It was thought the air pressure funneling through this channel applied pressure on the handle causing the handle to trip the manual release lever.



F-101

Prior to takeoff the pilot checked that he had a drag chute. When he landed he did not have a drag chute. No inflight indications of the loss were apparent.

The left main gear door was lost (no adverse flight characteristics resulted). Most probable cause: Overtorqueing of bolts causing inserts to pull out of the wheel rim.

Another left gear door loss was attributed to loss of the attaching bolt, indicating that it had either sheared or had not been installed properly.

KB-50

Two KB-50's lost refueling hoses, one when the hose unreeled after the pilot ordered the doors opened as a means of increasing drag during formation join up, and the other thought to be due to failure of the reel brake. A third aircraft lost an inspection plate when latching snaps malfunctioned, allowing the inspection plate to open into the slipstream and subsequently fail.

C-123

The forward emergency bailout outside hatch cover was lost during a high speed test run. Wind pressure on a hatch that was not completely flush appeared to be the cause.

UNKNOWN

A quart-size oil can was found on a lawn in the on-base housing area of a Far East base. The size of the hole in the lawn, the way in which the can was ruptured and the spray of oil that covered the side of the adjacent house indicated that the can had fallen from a considerable altitude.

SUMMARY

This is but a sampling. From it we can draw several conclusions.

- No aircraft is immune from the losing-pieces-in-flight hazard.
- Aircraft that carry objects slung under wings are most susceptible to inflight losses.
- Proper positioning and securing of external stores, hatches and doors is essential if inflight losses are to be reduced.
- If doors and hatches are improperly faired they should be repaired, and replaced if necessary, to prevent inflight loss from slipstream forces.
- Maintenance men and pilots must perform thorough preflight inspections.
- The man who closes the door or hatch must insure that the pins are in place.
- If it doesn't fit, fix it. Don't force it.
- If the aircraft has recently come out of inspection or IRAN, be particularly suspicious. Someone may have failed to put it back together properly—and someone else may have been careless during inspection. ☆

Annoying Incident? Serious Hazard? Regardless—

CANOPY LOSSES Must Be Prevented

The loss of an aircraft canopy in flight is generally treated as an annoying incident rather than a serious hazard. Repairs are made, the canopy is replaced and, after testing, the aircraft is put back in service.

During the past year there have been many fighter and trainer aircraft canopy losses in flight. In most cases there were no injuries, the canopy didn't fall on anyone or damage any property and the matter was reported as an incident. There were other cases, however, which were much more serious. One of these involved the loss of an F-104. And there was a T-33 which crashed and one member of the crew was killed. Perhaps, therefore, a look at the canopy loss problem is in order.

How serious a canopy loss can be depends upon many factors: type of aircraft, altitude, airspeed, time of day (daylight or dark), what happened to the canopy after it departed. The problems encountered subsequently may range from practically none to serious FOD that could cause a flameout and loss of an aircraft — possibly crewmembers, too.

The F-104 mentioned above crashed after the engine flamed out as a result of swallowing parts of the canopy. The T-33 accident occurred at night after the front seat occupant apparently jettisoned the canopy as the result of a misunderstanding. The pilot in the rear seat eventually ejected safely. ("Out in the Breeze," AEROSPACE SAFETY, Sept 1964.)

Other incidents have not been as dramatic, but they nevertheless subjected both crew and people on the ground to serious hazards. For example: some pieces of plexiglass entered the cockpit of a T-33 breaking the IP's visor cover and inflicting facial cuts; pilots reported rapid decompression; extreme discomfort on the part of the rear seat pilot, confusion and disorientation, vision impaired, pilots' visors shattered (rear pilot severely cut), cold, windblast.

Reasons for canopy separation in flight vary from design and manufacturing deficiencies to poor maintenance to crew or passenger error. In some cases the canopy simply was not locked prior to flight. In one case, a non-rated passenger accidentally jettisoned a canopy; fortunately he didn't squeeze the ejection trigger. There have been several losses from one type aircraft in which it appeared that pilots inadvertently struck the canopy control lever with their arms. Other causes include locking device out of tolerance, latch not completely locked, defective O-ring seal, canopy thruster failed, glass failed, cement failed.

On the ground, canopies have been lost because of carelessness and lack of knowledge on the part of maintenance personnel, indicating inadequate training.

Many reports of inflight losses, however, monotonously contain the statement, "cause undetermined." Some of these list a suspect, such as several regarding canopy damage in flight on the T-33. Most of these have contained a statement to the

This misplaced canopy didn't do any damage, but how about the next one that falls?

effect that the instrument hood was binding on the canopy. In these cases the entire canopy was not lost, only portions of the rear canopy.

A review of a number of Unsatisfactory Reports reveals:

- Slippage of laminated shims installed between canopy lock housing and upper longeron on 23 aircraft.
- 27 frayed canopy control cables were found during a one-time inspection.
- During closing cycle of canopy, the canopy lanyard cable extends too far into the terminal. The kinks in the cable bind on the terminal when the canopy is opened. The binding could cause the seat arming initiator to fire.
- Canopy received as serviceable from Supply was one-half inch narrower at forward end than replaced canopy and three other canopies measured.
- Canopy actuator received from Supply and installed on aircraft. When actuator clutch was disengaged and canopy raised manually, the remover housing separated from the actuator assembly. Caused by retainer being installed 90 degrees off in removed housing.

Considering the sums we are accustomed to dealing with today, canopy losses may seem trivial. But canopies do cost money, in materiel and manhours to replace; a lost aircraft costs a lot of money and jeopardizes the lives of crewmembers; anything falling from an aircraft in flight is a threat to people and property on the ground.

While there have been a few instances of canopies being jettisoned in flight by persons aboard the aircraft, most losses have been due to deficiencies in design of the product or maintenance. How can we prevent such losses? For one thing, quality control in manufacture and overhaul can be improved. If a manufacturer doesn't produce a quality product it only makes sense to get another source. When the product is a good one, its integrity should not be jeopardized by sloppy maintenance or the assignment of inadequately trained personnel to work on it. Pilots can assist by paying more attention to detail during preflight and by improving the quality of their 781 write-ups. ☆

Lack of discipline made this a...

Short Flight To Nowhere!

Excellent crew discipline has often spelled the difference between disaster and success when a critical incident hazardous to flight has occurred. On the contrary, lack of crew discipline has resulted in a fair share of catastrophes. But when the hazard exists only in the mind of the copilot, and consequently he takes action contrary to that of the pilot, well — the result may not be inevitable but it surely is to be expected.

The picture above illustrates the "to-be-expected" result of the following mishap. The flight was to be a cross-country from a northern base. Takeoff weather was as follows: 14-knot wind from the right, visibility one-half mile, light snow and blowing snow. The runway was wet and puddled. According to the accident investigation board, all briefings were performed, preflight completed, instrument readings normal, line speed 10 knots above minimum—in other words, everything normal until. . . .

The aircraft became airborne at 115 knots. The attitude was not to the liking of the copilot in the rear seat, however, so he pushed forward on the stick. The pilot up front reacted with back pressure to maintain the attitude.

Now the rear seat occupant really took over by retarding the throttle to idle and extending the speed brakes. When the pilot felt the throttle go to idle he reapplied power but by then the damage had been done. That airplane wasn't about to fly and it reacted to these schizophrenic manipulations in the only way it knew. It came back down on the runway with a thump. The nose gear sheared followed by the travel pod, left speed brake and left main gear door.

The T-Bird continued down the runway leaving landing light glass, pitot tube and part of the nose gear in its wake. The pilot blew the canopy and the aircraft finally stopped off to the left and near the end of the runway. The crew exited safely, however, a fire began in the tailpipe and had to be extinguished by the fire department.

Thus ended a two-minute flight. ☆

WATCH YOUR ATTITUDE, BUB

W. W. Braznell, Asst Vice President—Flying
American Airlines, Flushing, New York

The following article is recommended reading for all Air Force pilots. Since Mr. Braznell is writing for civilian pilots, some of the terminology does not agree with USAF standardized instrument terminology, and there are some minor procedural differences. Nevertheless, the article so coincides with concepts taught for many years by the USAF Instrument Pilot Instructor School that the school endorses its publication in AEROSPACE SAFETY. The article is presented here in the interest of flight safety; however, it should be pointed out that it does not replace in any way the appropriate Air Force manuals, regulations and tech orders.

In 1938, I wrote a paper on "attitude flying." In recent years, people have occasionally suggested that I bring this paper up to date or, in any event, once again treat the subject of attitude instrument flying in an attempt to refocus pilot attention on the merits of these concepts. Looking back on the events of the past 18 months leads me to believe some useful purpose may be served through renewing some interest in the subject.

It was back in the late 30's that I first started covering up the airspeed and rate-of-climb instruments on instrument checks. I was a new Chief Pilot, and my pilots were making me sick — literally — chasing the sensitive pressure instruments on proficiency checks. Particularly if the air was choppy, many pilots would fly up and down the radio range making procedure turns in a series of undulations punctuated by stomach retching "G bumps" as they attempted to arrest a plummeting vertical speed needle or, even worse, checked a rapidly decaying airspeed by a sudden forward thrust of the wheel—with a consequent excursion into weightlessness.

One day, when I thought I could stand it no longer, I wet two pieces of paper, plastered one over the Air Speed Indicator and the other over the Vertical Speed Indicator. The result was dramatic — the airplane immediately settled down and life once again became beautiful.

There followed a series of experiments leading to certain obvious disclosures. These disclosures became flying axioms insofar as my work as a Chief Pilot was concerned, and they have served me well over the years. Their application to the flying of jets has safety implications far beyond those of the DC-3 era simply because of the great speed range of the jet, its many configurations and, of course, the larger payoff for staying out of trouble.

Here are the basic axioms followed by a short elaboration on each.

1. Thrust (power) + Attitude + Weight + Configuration = Flyability. I shall refer to this as the safety equation. If the thrust is right for the attitude, weight and configuration, the airspeed will be within a few knots of target airspeed. Should the speed be more than a few knots off target, the airspeed system should be suspect and attention to proven thrust/attitude/weight/configuration combinations redoubled.

2. Thrust is the great compensator in the safety equation. Changes in attitude, weight or configuration in most instances mean a change in thrust. Every time an airplane is placed in climb or descent, flaps extended or retracted, gear raised or lowered, the question, "What happens to the thrust factor?" must be immediately answered and prompt action initiated by the attitude pilot.

There are, of course, those situations where configuration changes and attitude changes are effected without thrust changes, i.e., when losing altitude in the landing or ILS maneuvers. Here, the pilot may couple configuration changes with descent attitudes and rates, skillfully maintaining his target speeds without adjustments in thrust.

3. The basic instrument for measuring attitude is the gyro-horizon. Pressure instruments supplement the horizon, and under reasonably stable flight conditions are helpful for pegging the degree of precision in the horizon gyro. However, the airspeed or vertical speed instruments never take the place of the horizon for attitude fixing—unless, of course, the gyro tumbles.

4. Never fail to make a horizon erection and stability check as soon as possible after takeoff rotation. Check lateral indications by noting if the ball-bank is centered while holding pitch indications against airspeed and vertical speed.

Axiom No. 1. This past winter, a captain had a hair-raising experience. The aircraft's static airspeed ports were clogged with ice. Airspeed indications during takeoff and climb were subtly and deadly inaccurate. In his report, the captain stated that if ceilings and visibility had not been good he would have lost his ship.

We all know of a number of accidents caused by flying airspeeds, and I suspect some of the unexplained ones may also have been triggered by this most insidious of system malfunctions.

In the 1930's, a series of DC-3 faulty airspeed incidents and accidents gave birth to axiom No. 1. It was then that Fred Bailey, the Assistant Chief at Chicago, and I reasoned that if you placed a flying object in a given configuration at some attitude and supplied it with sufficient and constant thrust, it would fly at a fixed speed indefinitely once speed was stabilized—give or take a few knots (mph). And, it would continue at such a speed regardless of any variations on a speed indicator that may be attached to the flying object. (An accumulation of ice is considered a change in configuration and dealt with by adding thrust.)

Captain Bailey and I then proceeded to prove the point by covering the airspeed and vertical speed on training and instrument checks. Pilots were required to operate their aircraft completely by thrust/attitude/configuration combinations. We found that even landings and takeoffs on the airplanes of those days posed no problem to the properly "attitude"-oriented pilot. At any time he could call his airspeed within 5 mph (mph was in use at the time), and many a Chicago pilot on a proficiency check landed his airplane without benefit of airspeed or vertical speed readings with Fred Bailey or me adding realism by energetically handpumping nice milky alcohol over the windshield.

I do not advocate training a jet pilot to make takeoffs or landings without the aid of his full complement of instruments, but I would hope that the pilot who experiences a static system foul-up climbing out of some airport on a dark and stormy night will have conditioned his thinking and reflexes to the point that, knowing his thrust, configuration, and deck angle add up to a big fat and comfortable flyability factor, he can ignore an obviously improper airspeed value and equally ignore a wildly fluctuating vertical speed or altimeter. The same fervent hope applies to the thunderstorm or turbulent air situation. As we have heard so much about in the past few months, the control problem is solved if we can mentally pull down a curtain over the pressure instruments, set the thrust at the proper value and maximum flyability/minimum stress, and maintain the attitude of the aircraft within reasonable tolerances by reference to the gyro-horizon instruments.

Axiom No. 2. I was observing a training session in a simulator recently when the captain (obviously an exponent of attitude flying) asked the instructor for a thrust value to put into the simulator to produce approximately the target speed for the maneuver contemplated. I almost fell off my chair when the instructor replied, "Use whatever you need." Here was an instructor telling a captain to fly airspeed and only airspeed; advocating the substitution of a question mark in the flyability equation. According to this view, ? + Attitude + Weight + Configuration = Flyability. From an attitude flying point of view, this is as patently improper as a mathematician taking the position that 4 = 2 + ? "Flying by airspeed only" could well explain some of the industry's headlines of the past 18 months.

The first thing an "attitude pilot" does to become acquainted with a new airplane is to determine the margins above the buffet for certain basic key airspeed/configuration combinations. In our 123B and 720B Boeings, I would say that these "keys" are: (1) 200-210 kts., clean; (2) 150/160 kts., at 30-degree flaps; (3) V ref at 50-degree flaps.

Having in mind his "margins," the next step is to find out how much thrust is needed to produce these key airspeeds in level flight at good average takeoff gross weight, for maximum landing weight, for typical climb-out paths in terminal areas, and for a stabilized 2½ degree to 3 degree glide slope descent. Armed with this knowledge, the attitude pilot constantly and forever insists on a balancing of the safety equation. The speed he reads on his indicator must check with the speed he knows his airplane should be making good.

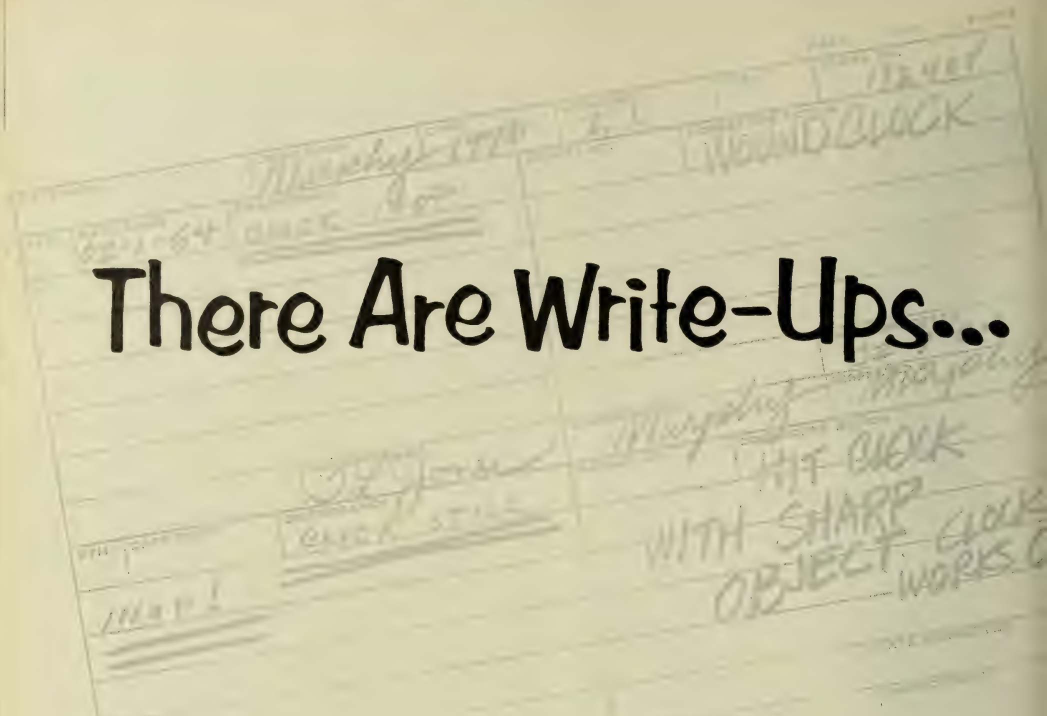
Axiom No. 3. For the precise fixing of attitude, full use of the horizon's trim knob is recommended. The target airplane should be zeroed to the horizon (1) before the start of each takeoff; (2) for cruise; (3) for flying a holding pattern; (4) for level flight at maneuvering speed. Using the trim feature in this manner, the pitch angles for climb and descent maneuvers at the lower flight levels will become apparent. Also, the progressively reduced pitch angles (with altitude) for maintaining climb airspeed and Mach will become reasonably fixed pitch increments.

Axiom No. 4. Horizons are not immune to failure. To perform accurately they must be properly erected and up to speed. Acceleration affects accuracy during the takeoff run and can develop 4 to 5 degree pitch errors. Precession errors develop in turns, and can account for as much as 4 degrees of pitch or 3 degrees of bank. There have even been cases where the electrical circuits have been reversed in maintenance, causing the instrument to indicate pitch down instead of pitch up—and vice versa. The most probable time for malfunction is during and soon after takeoff. So, as soon as possible after takeoff, the horizons should be checked out.

The recommended procedure is to use every means available: check one horizon against the other; check pitch indications against airspeed and vertical speed; check the bank indication by flying straightaway with the ball-bank centered. There are more sophisticated ways of making this latter check on late model airplanes, such as using the steer computer in HDG Mode; however, the most fool-proof method is to hold a heading and center the ball-bank.

We all know that flying has become quite safe; we haven't paid extra risk insurance premiums for years. It would be foolish to deny that a large measure of the progress aviation safety has made is due to the advantages a continuously improving technology has brought us. However, in the final analysis, a man at the controls who is well prepared to meet all situations with proven techniques is the ultimate safety factor. I feel sure that by diligently applying these attitude flying concepts that have stood up so well over the years, we can add just one more measure of safety to our daily job. ☆

There Are Write-Ups...


WOUND CLOCK
HIT CLOCK WITH SHARP OBJECT
CLOCK WORKS

Believe it or not, the above writeups are true. (They're too strange to be fiction.) The write-ups were made by a U-3 pilot, the corrective action by a U-3 "mechanic."

Frankly, they are used here to get your attention. They made us curious; we hope you will react similarly and read on. We talked to several people in the fixing business and they have suggestions they say will help them and, in turn, help you.

Did you know that all bases with like aircraft do not have the same test and repair equipment? If you have a dozen T-39's you have equipment not authorized on a base with less than five T-39's. A component that can be quickly tested and adjusted on the aircraft at your base may have to be removed and worked on in the shop at another.

A T-Bird was written up for nose wheel shimmy. The tire and wheel balance were checked. The same write-up was repeated. The assembly was changed. Again the write-up was made and again the assembly was changed. Nose wheel shimmy was again reported. Maintenance people did quite a bit of head-scratching on this one. What else could they try? They studied the write-ups again and someone noted that every one had been made by the same pilot. Other pilots had flown the bird, but none had reported nose wheel shimmy. Aid of the T-Bird training section was solicited and the cause was discovered and the problem resolved —the pilot had the habit of holding the nose gear on the runway too long during takeoff roll.

Here's a *don't* recommendation. The phone rings in maintenance, the maintenance officer answers and hears, "Uh, say, a couple of days ago I flew 943 and I noticed it seemed to want to turn to the right on the runway. At the time I thought it probably wasn't too bad, and maybe there was a little wind. But it did it during taxi too. I didn't bother to write it up, but I got to thinking about it some more; might be a dragging brake, or something binding. I thought maybe I'd better call and let you know. Probably doesn't mean anything, but . . . Yeah, you're welcome." Then the maintenance officer learns that 943 left this morning on an 11-day trip. He would much rather check it out than sweat it out; best of all, if the pilot had written it up the discrepancy would have been on the record and would have been checked for certain.

Along the same line, don't depend upon the crew chief to make the write-ups. Pilots, make your own and make them specific. Any descriptive information you can provide will help the maintenance technician. Over the years there have been some classics in the vague write-up category — and some deserved corrective comments:

No. 4 engine missing—No. 4 engine located.

Something loose in tail—Something loose in tail tightened.

...And write-ups, and write-ups!

Just imagine the wasted manhours that could be expended trying to locate:

Large connector broken on split line.

Panel on left side of aft section cracked.

How about this for a sure cure: Tail hook deployed due to unknown cause — tail hook bolted secure in up position.

Please, maintenance officers plead, make detailed write-ups, including all symptomatic indications you think might help the man who will be expected to troubleshoot and correct the squawk. If malfunction is intermittent, so state, along with readings of associated gages, if possible. If the IFF or TACAN works below 20,000 but not above, or intermittently above, be sure and include the altitude information. The repairman will be assisted considerably to know that a pressure problem exists. Does precipitation have any effect? This can be a lead.

Another thing, not all maintenance technicians are graphologists —though they may all have to come to this in time—so print, don't write, and make your printing legible.

Try to refrain from telling the doctor how to operate. List all the symptoms, let him make the analysis and the fix. Checking the length of the pushrods on No. 7 cylinder might be the first step, but likely not. All the technician needs is a clear understanding of how the system acts, in the air and on the ground; he can take it from there.

And pilots, the best way in the world to get clean, safe aircraft is to not accept those with discrepancies. Turn them down when they have write-ups like these:

1. Yaw damper inoperative, APG-30 inoperative, A-4 gunsight inoperative, external hydraulic line disconnect has slight hydraulic leak, anti "G" system inoperative and line capped off, heat and vent system went full hot—smoke entered cockpit (ram and dump cleared it out), fuel quantity intermittent, (drops from 7000 lbs to 4000 lbs. at times), canopy seal check valve missing, drag chute doors dented, drag chute cocking mechanism hard to operate, utility hydraulic reservoir leaks around cap (new cap does not correct leak).

2. Left hand flap seal retainer broken, right hand emergency ejection seat decal not legible, engine mount engagement screw rounded off, TACAN DME will not lock on at all (aircraft antenna bad), no sight reticle with airstart switch on, TR pack is not putting power to secondary bus, T-270 inflight control box removed for 780 equipment and fuel leak in dive brake area.

Hazardous as it may have been, two century series fighters were flown with these write-ups.

One more thing. A discrepancy that always gets written up is one that has to do with the pilot's comfort. If the cockpit heater won't work and the pilot is cold, or if it malfunctions and the pilot feels like he is in an oven, there'll be a write-up—in a very firm hand. But consider, if you will, the plight of the maintenance man. It's never too hot, too cold, too windy, too wet or too late to work on the engine. Chat with him when you can, especially right after you land. He may have questions to ask that are very pertinent to troubleshooting. You can help him help you. If nothing else, a kind word for the man who keeps your bird flying is a mighty reasonable insurance premium. ☆

TRI-SERVICE STANDARDIZATION

Cooperation and a lot of hard work over the past year have resulted in the Army, Navy and Air Force adopting identical criteria and definitions for aircraft accidents. Each of the services has changed its regulations and the standardized definitions became effective 1 January.

Historically, each service has gone its own way so no accurate comparison of accident experience was possible, even for like aircraft. Standardization of definitions and criteria is expected to benefit the entire military establishment by

- providing uniformity of accident data;
- increasing the validity of research efforts;
- allowing for full use of the mishap experience trends of all services for preventive measures—particularly for aircraft common to more than one service, such as the F-4 and F-111.

In order to achieve stability, there will be no unilateral changes in the criteria unless concurred in by all the services.

So far as can be determined, the standardized definitions may raise the USAF accident rate somewhat.

Regardless, standardization should benefit each of the services through the exchange of meaningful information. The gains to be realized are expected to more than offset any artificial increase in the rate that may occur. ☆

Fire is a frightening thing, whether it occurs in an aircraft, a missile, dormitory, dining hall or hospital. It's expensive, too. Air Force dollar fire loss for FY 1964 amounted to $17,000,000. In addition, 16 lives were lost and 142 persons were injured.

The above figures indicate the reason for the huge Air Force fire prevention program and why fire is one of those threats about which we cannot afford to be complacent. This article considers not the problems of fire prevention and fire fighting, but a more narrow question—that of saving lives in the event a fire breaks out in an inhabited area. More specifically, concern is centered on structure fires in such places as hospitals, dormitories, homes and like buildings.

Although the Air Force has been fortunate in that there have been no major hospital fires for several years, the same is not true of the rest of the nation's hospitals. Every six hours there is a hospital fire. More than 1400 times a year hospital personnel in this country find themselves turning in alarms, using first aid fire fighting equipment and removing patients from the danger area.

The investment in equipment and systems to guard against fires is considerable. There are automatic sprinkler systems, detection and alarm equipment, explosive proof electrical equipment and devices to control static electricity. These are needed in an environment that includes products such as ether, acetone, oxygen, ethylene, alcohol and other potential "bombs."

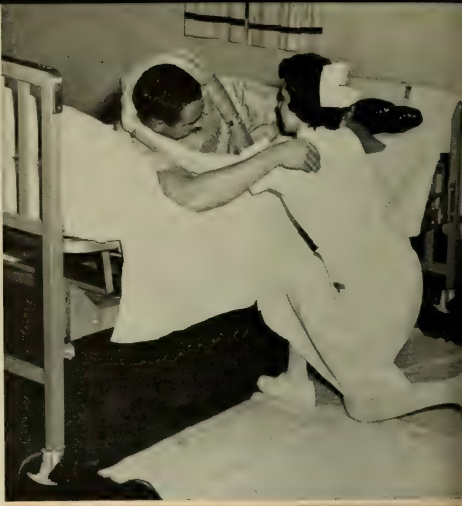
Homes and dormitories sometimes contain some of these products or other combustibles that can quickly turn a flicker of flame or a spark into an inferno. But even when no such materials are present danger still lurks: nearly one-fourth of the fires the Air Force experienced in the U.S. during FY 1964 were caused by matches and smoking materials. Electric wiring systems and electric appliances were also heavy contributors.

It is obvious then that Air Force personnel may at any time find themselves on the firing line, that they must rescue a friend, relative or, in a hospital, a patient.

During the day there may be many people about, some of them highly trained in fire fighting and rescue. At night it's different, particularly in hospitals where the staff is down to a bare minimum. Then each person has a grave responsibility in case of fire.

For several years the Norton Air Force Base Fire Department has conducted training for base hospital personnel. At the request of the hospital administrator and chief nurse, the author prepared a program which includes lectures in fire prevention and demonstrations in fire fighting and rescue procedures.

The pictures on these pages illustrate rescue practice. They show how a 110 pound woman might remove a 200 pound man from a bed. While the pictures were made in the hospital, the same techniques can be used by anyone, whether the subject is a patient or an airman in a dormitory overcome by smoke or flames. There were 283 fires in Air Force dormitories and quarters and 379 in family housing units during FY 1964. Therefore, these techniques can be equally handy in home, hospital or dorm. Take a good look—you might save a life. ☆



1

Firemen are taught firefighting and rescue techn
but what if YOU should find yourself in a sit
where only you can save a life? Could you rem
200-pound victim from a fire-swept room?

TO SAV
A LIF

Alfred S. Hastings, Fire Inspector, Norton AFB, Cali

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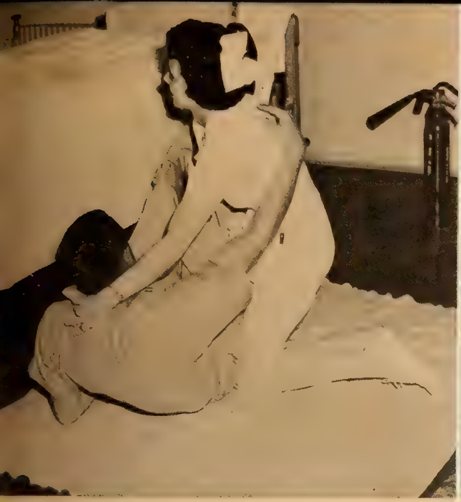

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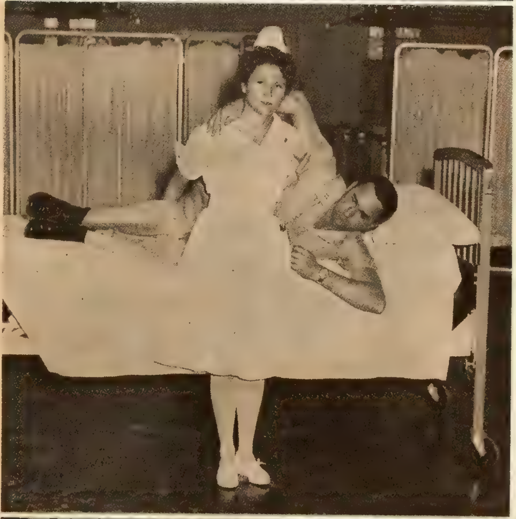
BLANKET DRAG (Photo 1)—No lifting is necessary as nurse pulls patient from bed with both hands and pushes with her knee. As patient leaves bed, nurse must drop to left knee. Cradle formed by knee and arm protects patient's back (Photo 2). Nurse lets patient slide gently to blanket and pulls blanket from room.

While one nurse operates hand fire extinguisher (Photo 3), another uses HIP CARRY (Photo 4). Nurse approaches from left side and slides her left arm under patient's right armpit. With knee slightly bent, she reaches back with left hand and grasps patient's legs behind knees. Nurse then draws patient across her hips before leaving bedside (Photo 5). She stands erect and straightens knees, then walks with chest out and shoulders back.

SWING CARRY (Photo 6)—Nurses flank patient facing same direction. Each takes a wrist and pulls patient's arm around neck and across her chest. Nurses then reach under patient's knees and grasp other's wrist. Patient holds shoulders of nurses.

THREE-MAN CARRY (Photo 7)—Nurses slide patient to edge of bed, lift together and turn patient to face them. Then they carry him from room. "Sliding" and "lifting" should be continuous action.

4



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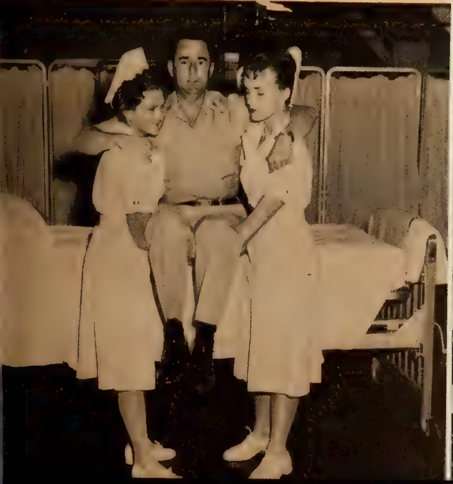
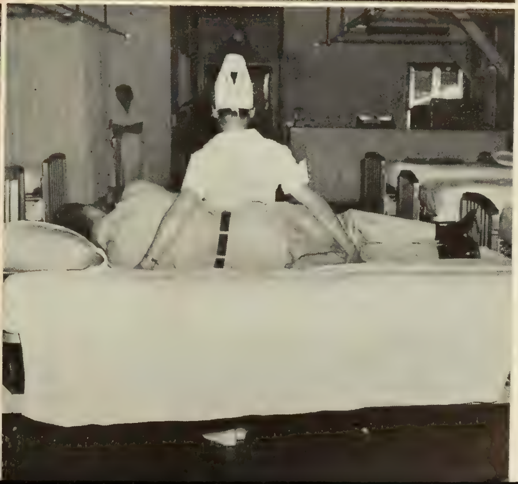




PREPARE

PREVENT

E. R. Roth, Directorate of Aerospace Safety

The cliche, "the bigger they are the harder they fall," fits strategic liquid propellant systems. When an accident occurs during a propellant loading exercise (PLX) and it results in fire and explosion, the launch facility (silo) will usually be completely destroyed. This has been confirmed by inspection of several Atlas F sites after such mishaps. Fortunately no injuries or loss of life resulted in the Atlas F accidents, but there were some close calls. In most cases the lapse in time from the first emergency indication to the actual explosion was more than an hour.

Why did the accidents occur? Why couldn't they be prevented? One answer is lack of system and personnel preparation. If both the system hardware and the personnel were adequately prepared for the job, some of the past accidents might have been prevented. This article discusses system and personnel preparation and their significance to safety and accident prevention.

SYSTEM PREPARATION

In at least two incidents there was a history of critical system malfunctions in the missile lift systems and propellant transfer system. In the former the discrepancies involved launcher platform (L/P) movement with jerky action, intermittent stopping and seizing of the drive brakes. In the latter there were liquid oxygen (LOX) leaks. The reasons for some of these malfunctions were never adequately explained or corrected. Conducting a potentially hazardous operation without performance verification of the status of these subsystems does not constitute preparedness. In both cases, a complete functional checkout of the L/P lift system and an investigation of transfer loading system leaks should have been accomplished.

The proper operation of Real Property Installed Equipment (RPIE) is necessary. Facility equipment, such as ventilation and air conditioning, water and power distribution, detection and warning, communications, fire protection system and blast door interlocks, is just as significant as the Aerospace Ground Equipment (AGE) hardware. Malfunctions in the RPIE have contributed to catastrophic accidents.

Failure of a missile enclosure exhaust fan to stop in response to a gaseous oxygen alarm signal caused O_2 concentrations to be drawn into a diesel engine exhaust plenum. This condition resulted in the outbreak of a flash fire.

In several of these mishaps the water fog system had failed to operate when needed. If this system had functioned, the accident might have been prevented. In this situation and in the preceding example, the malfunctions could be attributed to *not* performing a functional check of these systems prior to a PLX.

Another case of lack of preparation was the existence of hydrocarbon contamination during a PLX. Small amounts of diesel fuel and hydraulic fluid had contaminated an area of critical components (LOX transfer system). Although some action was taken to clean up the fluid that had leaked, there was no verification that the sources of the leaks were located or corrected.

Mechanical interlocks are installed on blast doors to insure that they are closed at all times. The doors are designed to protect the Launch Control Center (LCC) from the overpressures of an in-silo explosion. PLXs have been conducted with mechanical interlocks inoperative or removed.

PERSONNEL PREPARATION

It is significantly important that operational crewmembers be prepared to fulfill their job responsibilities. A strategic missile system is too complex for any one individual to know the total system details, therefore the applicable crewmember must be prepared to advise missile combat crew commanders (MCCC) on his specialty. Several accidents have occurred because crewmembers did not do a task, were not knowledgeable or lacked training in details which affected the safe operation of the system.

An L/P was being raised with a loaded missile during a PLX. An RP-1 fuel leak in the L/P side of the fuel disconnect was observed on TV. The RP-1 fuel spill occurred because a specified manual line drain operation had been overlooked! The L/P was kept up and locked during cleanup of the spill. At the same time, the non-essential bus was shut down on the recommendation of a standardization crewmember, who thought that removing power from electrical outlets in the silo would preclude an ignition hazard. This action was *not* specified in technical data. Shutting off the power de-energized water pumps which circulate condenser water to diesel generators, water chillers, exhaust fans, and other RPIE. This caused overheating of the diesels which, in turn, generated explosive vapors that contributed to the initial explosions.

When an emergency malfunction occurs during a countdown, safety and crew personnel should be prepared to investigate the situation when the MCCC gives the word. They should be prepared to put on self-contained breathing apparatus and the necessary protective clothing and use available safety equipment (such as portable oxygen or fuel detectors). Accident investigations have indicated that personnel have been sent into silos to investigate emergencies (location of a LOX leak for example) 30 minutes or so after the first warning. This action, if necessary, should be done as specified in tech data (assuming other conditions remain the same). There have been some very close calls because the decision to dispatch personnel to the silo was delayed until there was no longer time to investigate, but just enough time to get out before the blast.

Adequate preparation includes a complete understanding of who has overall responsibility for operations at all times. Regulations point out that the MCCC is in full charge at all times unless relieved by proper authority. For example, a standardization MCCC (and his crew) may take over if he feels such action is required to preclude loss of life or major damage to equipment. This action should be announced and acknowledged. In one accident, an MCCC bypassed a step in the checklist because he was so advised by a standardization MCCC. The standardization MCCC, however, had not officially relieved the MCCC of his command.

Missile teams for diagnosing potential hazards must be on call to decide on the emergency action required to avoid a catastrophe. These teams have been rendered ineffective because of the lack, or malfunction, of communications, poor amplification, reproduction, and because the required experts were not on the net to resolve the problem.

The above examples point out that one of the keys to safety is preparation.

System preparation means proper functioning of all subsystems, including RPIE and communication networks. To assure safe performance during critical operations, a complete system checkout is mandatory. Crewmembers must also be periodically tested to determine if they have retained their proficiency. A prepared individual knows his job (electrical power production, missile facilities, etc.) and the responsibilities that go with it. These include his capability to perform specific jobs in accordance with authorized technical data. He must also function as a team member. Testing of crews as to what actions they would take when given specified emergencies during a simulated countdown is an excellent approach. Emergency procedure training with written examinations must be a continuing program. Crew preparation must always include an understanding of each crewmember's responsibility and authority. This is particularly important during countdowns, critical operations and emergency conditions. ☆

Chumley and friend barely make it on a trip...

SOUTH OF THE BORDER

The T-Bird made three quick bobs to the left, then rolled on by the first taxiway. Seconds later Captain C. Z. Chumley struggled out of his hard hat to the accompaniment of the dying whine of the engine. He rubbed his hands together and called over his shoulder, "Lieutenant, get that travel pod open and dig out the laugh and play clothes. Fella doesn't want to waste time—don't get to these border towns very often anymore."

"Uh, sir, what about the write-ups; those surges, tendency to roll to the left, I have an intermittent reception problem with my headset, there's a vibration in the—"

"HOLD IT!" Chumley cut him off with a wave of his hand and clambered out of the driver's seat. "That's all trivial stuff. I'll tell the transient guy to give her a look. We'll write it up when we get home."

"But, sir," the lieutenant was persistent, "about those fumes I noticed, I—"

"C'MON!" Chumley jumped to the ground. "I lit the filter end of a cancer stick a while back; that's probably what you noticed." He glanced at the clipboard the white coveralled transient maintenance man handed him, scrawled his name across the bottom and instructed, "You fill in the squares, Sarge, just fill 'er up. We plan to have wheels in the wells by oh eight hundred."

"No maintenance necessary? I thought I heard the lieutenant say..."

"Minor stuff, don't want to trouble you."

"Sir," it was the lieutenant again. He came out from under the wing holding two clothing bags, "that radio would only take a few minutes."

"I think we can have a man look at it right away," the sergeant said. "As you know, our transient maintenance hours are from eight to five, as shown in the Enroute Supplement, but," he looked at his watch, "there's 30 minutes left. He can probably change the interphone box."

"That's O.K., Sarge, we won't need it." He turned to the lieutenant. "I'll take the back seat tomorrow—you can hear fine up front." He looked around, "Where's crew trans . . . oh, there it is." He whistled shrilly at the driver of a yellow van. "We're ready," he called.

Stripped to their shorts, Chumley and the lieutenant shaved in front of the small mirrors in the men's latrine. "Ya know," Chum mumbled through the lather, "I gotta put the pr's're on Rex Riley — gotta get better facilities 'specially at these border towns." Later, while enroute to the border in the rear seat of a rickety taxi, he added, "Gotta talk to Rex about this transport situation, too. For safety's sake should have staff cars, with seat belts, to provide off-base transportation."

The lieutenant maintained his grip on the left arm rest. He could use one of those drinks Chumley had raved about, and he had to admit he was curious about the anatomical exercise demonstration. Later, after three margaritas and watching, bug-eyed, as the belly dancer did torso gyrations that completely defied all engineering parameters he had learned about in college, he began to share Chum's love for the Latins. "Y'sir," he said at one point, "I w'rry too much, Shaunce, ole pal, I believe we can fly back in the mornin', ev'n without thas 'old T-Bird if nec—ness—necs'ry."

Came the dawn. At first the lieutenant tried to figure out where that groaning was coming from. He shuddered when he realized he was making it. He sat up, and his head tried to explode.

He blinked his eyes and the blurred figure moving around on the other side of the room became Captain Chumley. He looked around the room. It was a complete shambles. "What happened?" he asked, nursing his head in both hands.

"Oh, the room," Chum laughed. "This, my friend, is the arena. This is where, shortly after midnight, 'ze great bull fight' was put on."

The lieutenant slid one hand up to the top of his head, touched the knot there and groaned again.

"That's the way it ended," Chum explained. "You insisted on being 'El Toro, ze buull'. You stood over by the door, pawed the floor, and when I cried 'Ole' you charged across the room, tripped over your new pair of cowboy boots, went headfirst through the red shorts I was holding and drove your head into the wall."

"Oh..h..h," the lieutenant groaned. Suddenly he belched, then grabbed his midsection in agony. "Don't tell me I tried to do that belly dancer act, too."

Chum leaned against the door-jamb and wiped tears from his eyes. "No," he laughed, "that was the 'El Grande Combination Plate'. Remember? You poured hot sauce over the whole thing."

"Oh..h..h." The lieutenant struggled over to the sink and gulped three glasses of water. "Got any aspirin?" he asked. "Maybe a small fire extinguisher?"

"Here," Chumley dug into his shaving kit and came up with some pills. "Here's some APC's and seltzer." He looked into the kit again and shook his head. "Sorry, no fire extinguisher. Wait, maybe this will do." He held up a can of shaving cream.

"If it's mentholated, I'll take it," the lieutenant groaned again. He looked out the window, then turned away as the bright light seared his eyes. "Aren't we supposed to have the wheels up at eight?" He began hunting around for his watch. "What time is it?"

"Almost noon. No sweat. I cancelled out. They've found some troubles with our bird. Can't go until tomorrow. C'mon, get dressed, will ya. We gotta go out. I understand the Base Ops officer wants to see me." The lieutenant went from immobility to slow motion, then speeded up when Chumley said, "Hurry it up. We'll get you a big vanilla milk shake."

At the field Chumley said, "You go get the milk shake and see if it will help put out the fire. I'll see what the Ops Officer wants." He went down a hallway, climbed a set of stairs and knocked on a door with the words OPERATIONS OFFICER on the glass.

"Come in," a gruff voice said.

"Sir, Captain Chumley. I understand you wanted to see me?"

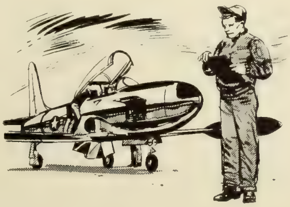
"Chumley, oh, yes," the Lt Colonel said. "You the pilot of that T-Bird out there?" Chum walked over, looked out the window and saw a T-33 parked in front of the hangar. Cowling was scattered about; there were jacks under both wings, a fire truck was parked just beyond it and mechanics were crawling all over it like kids with a new toy. Chum checked the number on the tail.

"Yes, sir. What's going on anyway. Looks like you guys are dismantling it. Put it back together. I'm on a tight schedule."

"Captain, sit down!"

Chumley did. The Lt Colonel pushed a button on his squawk box and said, "Send Major Lea in."

A sharp-looking major appeared almost instantly. "Lea, this is Captain Chumley. He's the pilot of that T-Bird. Want to tell him what we found?"



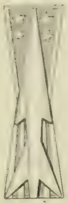
"Yes, sir," Lea said, then turned to Chumley. "Captain, our transient alert people take special pride in providing prompt, dependable service. They always make a walk-around. We've found that some pilots hit the ramp running for the border and we'd have a lot of bashed birds off the end of our runways if we let 'em out the way they came in. Your case is classic. The first thing they found was a tire with cord showing in three spots. Got a bad left brake or a pilot with a ham foot. They were going to try and get it changed last night so you could make good your, ahem, eight o'clock wheels up, but soon noticed hydraulic fluid in the left wheel-well area. When they put pressure on the system, whoosh —a cracked line. One thing led to another and, in accordance with the T.O., they had to pull a retraction test. They decided to taxi your bird up here to the hangar area and that's when they found they had *real* troubles. The mech in the back couldn't call for taxi clearance—bad interphone. They noticed fumes, shut it down and got a tug. The fumes came from a cracked hydraulic tank cap. The engine had a tendency to surge so they pulled a power check. Sure enough, the fuel control valve had to be changed. On the retraction test it was discovered that the left main gear door was warped way out of shape. Sheet metal people are working on it now. I'd think you'd have noticed a tendency for the bird to roll left. Also, there was a broken linkage rod on the right speed brake and we couldn't get it to close flush. I'd think that would have given you a vibration." The flying safety officer looked at the Ops Officer. "Those are about all the major items I think of off-hand."

The Operations Officer scowled at Chumley. "Captain," he said, "all I have to add is this. If you persist in flying airplanes in such a condition, then not bothering to make write-ups, I have a suggestion that will probably save your life. I suggest you become the most proficient pilot in the Air Force in flameout landings as well as the fastest man on the ejection triggers."

Chum's head hurt, his eyes burned, and the last thing in the world he was in the mood for was a chewin' by people not even in his own command. He decided to play it meek, to get out of there.

"Yes, sir," he said. "Thank you for all the extra service. Maybe I can do a favor for you sometime."

"Yes," the Lt Colonel nodded. "Yes, possibly you can. I would consider it a great personal favor. Please, never land here again." ☆



MISSILANEA

FOR OR AGAINST? Probably, at least once, every car owner has had that horrible experience of locking his car keys inside the vehicle. Such carelessness often creates considerable inconvenience and some embarrassment, but is seldom a hazard. The same conditions are not true with a missile weapon system.

Recently, a helpful missile maintenance technician (MMT) opened a Minuteman launch facility for a contractor-installed modification. The accommodating MMT was so eager to assist that he rushed through the prescribed sequence of operations. Apparently, the checklist was a retardant, so he placed it in a secure place and relied on memory! The checklist was so unimportant to this MMT that he inadvertently left it within the launch facility. He then secured the silo without mishap, fortunately. Alas! Another entry was required. The MMT possessed great skill and confidence. He reopened the launcher — without benefit of checklist or technical data (even though a technical order was in a nearby vehicle).

This MMT is a skilled but careless workman. Does he work for you? Or, does he work against you?

The austere appearance of the Minuteman launch facility is deceiving. The adage "Familiarity breeds contempt" is worth considering. Check your people for use of checklists!

Lt Col Valdean Watson
Directorate of Aerospace Safety

WHO EVALUATES THE EVALUATOR?—The Command Evaluation Crew conducted an evaluation of a Missile Combat Crew during a propellant loading exercise. The countdown proceeded successfully and without incident to completion. When the Crew Commander pressed the Lower Launcher Button, the console indications appeared normal; however, after normal timing out of the logic, the launcher failed to move. The missile was, in effect, "stuck above ground." Technical data emergency procedures called for boiloff of the missile.

While the duty crew researched tech data, and before initiation of missile and facility safing and boiloff procedures, members of the evaluation crew departed the Control Center. They proceeded topside, entered the hazard area, approached the launcher, and finally, from the lip of the silo, looked over the edge to see if they could ascertain the malfunction that had disabled the launcher. This activity was accomplished without any coordination or approval of the duty Crew Commander or Site Commander and despite a pre-countdown safety briefing which specifically prohibited such action. Suffice to say, had these actions been accomplished by a crew being rated, they probably would—and should—have been assessed with a major error and therefore would have failed the evaluation.

The violation or deviation from procedures is serious enough; the unnecessary hazardous exposure of personnel is unforgivable.

Major K. H. Hinchman
Directorate of Aerospace Safety

CONTAINMENT. While maintenance personnel were assembling and checking out an air-launched missile, inadvertent ignition resulted in the missile going propulsive. Three fatalities resulted.

The team included not only local maintenance personnel, but also an assistance team from the responsible AMA. The nonpropulsive attachment (NPA) is a standard item of equipment for these missiles but was not available during assembly and checkout. They should have known better, but . . .

The press of time prevented the operation from being delayed until the NPA was available. But, was the time involved worth the risk? The training mission was delayed by the loss of the missiles involved. Had the NPA been used, injury to the technicians would probably have been limited to burns.

At another base, a missile had been loaded on the aircraft but the umbilical cable was not connected. The missile ignited, left the rail and hit the ground 30 feet away, skipped along the ground and hit two bicycles and a fence. Members of the loading crew and a bystander were injured. This is another example of the inadvertent initiation of an igniter. Had the aircraft been aligned with an inhabited area, more serious damage than two bicycles and minor personnel injury could have resulted.

In a solid missile, the igniter is often cast in the propellant grain. If the missile is in a propulsive configuration and the igniter accidentally initiates during assembly, maintenance or checkout, accidents such as the two above will occur. Electro-explosive devices, similar to the igniter mechanism used on solid missiles, have been used for years by earth-moving companies, mining, and petroleum industries. These industries have achieved an excellent safety record by continually emphasizing the necessity of care and caution in the handling of pyrotechnic devices.

Missile propellants fall into the category of explosive components. We can profit by industry's example. You, the technician, must use care and caution with explosives; you the supervisor, must instruct your people on safe operations, and everyone must exercise a healthy respect for these explosive components. This includes using containment devices such as the NPA, barricades in shop areas, and impaling devices for large solid missiles which will prevent a missile from going propulsive and destroying a housing area or anything else in its path.

Maj Moses R. Box
Directorate of Aerospace Safety

Rex Riley's CROSS COUNTRY NOTES

THERE'S ALWAYS A DITCH. Rex remembers "there's always a ditch" as a favorite expression of a command chief of safety. He would come in, accident TWX in hand and shaking his head, and make the remark. Actually, it is quite surprising, when a guy goes off the far end, how often his bird bounds along in the boondocks with little or no damage until it comes to the inevitable ditch. Here's the topper. These transport troops, inbound to a non-ZI base, received landing instructions when 30 miles out. Two subsequent contacts were made with the tower, one at 10 miles, another at seven. The aircraft was cleared to land. After landing the crew spotted a ditch across the runway about 500 feet ahead. They got on the binders, but still hit the ditch at 30 to 40 knots. At about this time the tower controller advised that the aircraft had landed in a construction area. Now he tells 'em! Miraculously, the report says, damage was limited to three changes (tires) and one nicked and bent prop.

TEMPORARY INSANITY? One of the first traits Rex ever felt called upon to publicize was the exercise of self-discipline. Years ago it was necessary to point out the tragic price that a few young tigers paid for unauthorized buzzing. It required a complete disregard of orders, trust and common sense for a pilot to attempt low altitude acrobatics to try and impress a girl friend or relatives. Enough young Air Force officers were killed in this manner, and enough publicity given to the hazards, and enough teeth put into disciplinary action against surviving offenders that this problem gradually faded.

But it has not been eliminated. Information recently received tells of a pilot, flying a target mission, who took unauthorized evasive action, close to the ground. This unauthorized maneuvering was not required for mission success, was extremely hazardous, and terminated when the pilot allowed his aircraft to crash. During the holidays, one of our vacationing safety types reported driving through a flat area of "ETO" and seeing a century series jock come busting along at grass top level, then pull up across a busy highway. Off in the distance, in the direction from which the jet had come, was a small town.

Any pilot who suffers temporary insanity of this kind, and subjects innocent citizenry, his equipment and himself to extreme danger, does not deserve to be trusted with the responsibility incumbent for an officer of the United States Air Force.

DRAG OVER THRUST—This is kind of hard to believe, but it happened. The pilot is supposed to have preflighted an Aero Club T-34, after which he taxied out and took off. Somehow the aircraft got up to about 50 feet and the pilot got the gear up, then the machine stalled and returned quickly to the runway. Seems the preflight wasn't quite thorough enough: a 200-pound block of concrete was still tied to the tail.

CHAPEAU. Because weapon system humanus was designed with a frangible head, safety hats have been designed to protect this area from falling or flying objects. From ATC we gleaned the tips that these safety hats are water resistant, non-conductors of electricity and fire resistant. They are available in several types and, as any one who has been around a missile site knows, come in a variety of colors. If you are issued a hat because of your working environment, take time to fit it properly. Proper adjustment provides for at least one and one-fourth inch of space between the top of the head and the inside crown of the hat. This space provides a cushioning effect should an object fall and strike the hat. Some other tips: never wear a metal type hard hat around electrical hazards—use the non-conductor type, never drill air holes in your hard hat—drilling may cause the material to crack, wear your hat in designated areas—like the seatbelt, the hard hat is worthless unless worn. ☆

THE DEAD HERO

From the F-100 cockpit, 42,000 feet up, the night sky was a ceiling painted with India Ink and decorated with glittering white jewels. Because of the clarity of space, the stars actually appeared to be closer than the man-made lights imbedded in the haze eight miles below. The air here was smooth, and the fighter that sped through it was disturbed only by the faint vibrations from its turbine. The chalklike contrail the plane left in the thin air slowly dissipated as it spread and dissolved into the night.

For the pilot this was a busman's holiday. This supersonic fighter was designed to perform a variety of exacting missions from ground level into the stratosphere. Tonight's mission was a simple cross-country flight to deliver the aircraft for IRAN. Routine monitoring of engine instruments and navigation from one TACAN station to the next was all that was required. ARTC was following the progress of the beacon return and had eliminated the requirement even for routine position reports.

Duck soup.

Whoof!

The lieutenant felt and heard the sound at the same time. Instantaneously his body tensed and his eyes flicked from one engine instrument to the other. His reaction was so quick that he was able to catch the first movement of the engine RPM gage as the needle began to unwind. Tailpipe temperature was falling and he caught that. But these gages merely confirmed what the seat of his pants had already told him. That awful coasting feeling had replaced the steady pressure that had been boosting him along. He tried to catch the flame. Nothing.

"MAYDAY, MAYDAY, AIR FORCE JET 38246, FLAME-OUT!"

"Air Force jet 38246, Kansas City Center. Copied your Mayday. Understand you have flamed out. Recommend you squawk emergency. What service can . . . we note you are now squawking emergency . . . what service can we provide?"

"Rog, Center, will let you know."

Most every emergency triggers a series of reactions. Not all of these are always correct. The lieutenant now took an action which might prove to be the first in a series that could later be construed as possibly being incorrect. Some ingrained instinct for survival caused him to bank left and point the nose of his fighter toward a glow of lights south of his course. He lowered the nose as he did so to maintain best glide speed.

His eyes flashed from one strument to another, then he forced himself to take time as he realized panic was making him scan at a pace that would not permit interpretation. Fuel pressure was down, oil temperature dropping — confirmation of what he already knew —flameout! He checked his fuel quantity and selector. That wasn't it. Icing? Couldn't be, in a clear sky, but he turned on his deicing switch anyway. Emergency fuel—the checklist items, one by one. He had time to do it right. Now an airstart attempt. It failed.

"Air Force 38246, we observe you turning south. We will keep other known traffic clear and provide vector service and other assistance as desired. What are your intentions?"

He had to tell them something. But his plan wasn't firm yet. Get an airstart if he could. If not, punch out, probably, though he hadn't given that any conscious thought as yet. Something had told him to turn toward the lights of the city though. He didn't have any better plan. He would stay with it for now.

"I'll try another airstart. Will orbit in the vicinity of the city coming up ahead. Will keep you advised."

"Roger, Air Force 38246. We will clear the area of known traffic. Will Rogers Airport is seven two miles from your position. We can provide vectors."

"Rog. Thanks. Not now."

Altitude 28,000. He tried another airstart. Nothing. He would try again at 25,000. The city was coming under the left wing now. He banked left, eyes searching, and picked out the beacon and then the slender rectangle of lights outlining a runway. He checked the beacon again and caught the flash of green. He would keep the field in sight.

"Kansas City, Air Force jet 38246, request surface winds, my vicinity."

"Air Force jet 38246, stand by. Neosho altimeter three zero zero six."

"Rog. Three zero zero six."

"Roger altimeter. Winds one four zero, eight knots. What are your intentions?"

"I'll try for more airstarts." He glanced at his altimeter and widened his turn. "I'll set up a flameout pattern in case I can't get a light. If it looks good I'll consider landing. If not, I'll aim away from the city and punch out."

"Roger, Air Force jet 38246. Joplin Radio is 255.4."

"I'll stay with you. I'm pretty busy and don't want to fool around changing radio frequencies."

He ran through the airstart procedures again. Nothing. Altitude 18,000. He picked up the field and tightened his turn. The dryness in his throat was more pronounced. He ran his tongue across his lips and hooked the zero lanyard. Another airstart try; deliberate. Making sure he didn't miss a thing. RAT on. Check shoulder harness locked.

"Kansas City, Air Force jet 38246. Request field elevation."

"Air Force jet 38246, field elevation at Joplin niner eight zero."

"Rog," he said. Center was really on the ball. He tried another airstart and started his turn from high key. There was a call on the radio. He didn't catch it but did catch the reply by Center.

"All aircraft—make no calls on 322.4. There is an emergency this frequency."

Low key now. No more airstarts. Concentrate on pattern. Should get out. But pattern looks perfect. Just a little longer. Airspeed 220. Still looks perfect. Gear . . . now! On final, speed 200. Just a little high. Full flaps. Committed! Dropping low now, THUMP! What was that?

The lieutenant added back pressure as, peripherally, he caught the first runway lights. He reached for the drag chute handle and felt the gear hit as he came even with the lights. He jerked the handle. The nose dipped much lower than normal and he heard the screech of metal on the runway. His nose gear had collapsed. He braced himself on the brakes, trying to keep it straight.

The entire emergency had been one series of exacting tests after another. He'd done all right so far. If he could just get it stopped. One more break, that's all he asked.

The lieutenant's last mortal sensation was the flash that signaled the explosion.

Later, the accident investigators pinpointed the explosion at the 2100-foot point on the 5500-foot strip. They estimated that the aircraft had nearly stopped at the time. He had *almost* gotten away with it.

Analysis of the wreckage disclosed the cause of the explosion. Fuel from a broken line had puddled in the belly of the fighter and, possibly ignited by a vibration spark, had exploded to scatter plane and pilot parts all over the runway. A few seconds more and the lieutenant could have climbed over the side and stood waiting for the police car, fire truck and ambulance that, alerted by a call from FAA, raced onto the field and down the runway to the smoking wreckage.

When the evidence had been examined, and as the investigators sat around the table in the accident board room, one said, "If we are to benefit from this accident, it must be that we are to again emphasize the Dash One instruction that says flameout landings should not be attempted at night."

"The irony is," another board member interjected, "his flameout landing was almost perfect. He missed clearing the utility pole with his nose gear by less than two feet. Otherwise he had it hacked—I'm convinced he would have been able to stop—then, blooey! There's a mighty slim chance of pulling off a night flameout landing on a 5500-foot strip. He came close, awfully close, then died when he probably figured he had it made."

"Gentlemen," the president of the board spoke up, "we have to wrap this up. Let's recommend that this accident be publicized in the safety magazines. It's a little more dramatic than some when we realize how close he came to making it. But the end result tends to substantiate the Dash One procedure against attempting night flameout landings. The Air Force has paid a high price for this lesson—a pilot and his plane. If we are to benefit, it may be that some other pilot faced with a similar emergency, will remember this accident, eject and live. Also, we have a little more ammunition to use in the battle for better quality control."

The recorder wrote the recommendation down, then read it back.

The board president tapped the eraser end of his pencil on the table. "You know," he said, "because this guy came so close, if I were writing this story I know what I'd title it: *The Dead Hero*." ☆

A sucker hole,
three engines out.
That's when I discovered . . .

THE REAL GOAL

By A USC-FSO Student

When I think of accident prevention, a personal experience always comes to mind. One morning last January I was scheduled to conduct a C-97 acceptance test flight at an IRAN facility. Acceptance flight test of multi-recip aircraft is my business and my present way of life.

The day started out on the wrong foot. The weather was foggy, rainy, cold and it was Monday. After arriving at the office I was told that all aircraft deliveries were behind schedule. Although the weather was below that required for flight test, we scheduled our crewmembers to the aircraft that were supposed to be ready for flight this day. Each crew had two aircraft on which to complete a green preflight and test flight. This usually takes a full day even when the weather is good.

I decided to take my crew to the aircraft and start a preflight. After arriving at the bird it looked like the last thing it wanted to do was fly. We climbed aboard and the first thing I saw was a cockpit which looked as of it had been cleaned with a water hose; practically everything was soaked.

Our preflight was satisfactory except for some minor discrepancies and inoperative VHF and UHF radios. The radios had to be repaired before flight, so we returned to the flight building to recheck weather and await repairs.

The aircraft was ready for flight just after lunch. A quick check of the weather showed a multi-layered, scattered to broken condition from 2500 feet to 18,000 feet with an occasional scattered layer at 1000 feet. The rain had stopped and visibility was eight miles on the ground. Everything considered, I decided to go. All I needed was 2500 feet and a clear area in which I could pick my way to VFR on top and also another hole through which I could descend.

In my desire to try and get this aircraft ready for delivery I decided to push a little harder than normal. We taxied out and completed a normal test flight runup. This included a complete check of all systems. No major discrepancies existed so we taxied to takeoff position.

Takeoff in this aircraft was a very interesting experience. The gross weight was only 104,000 lbs., compared to 153,000 lbs. when ready for departure from a line organization. As a result of the light gross weight, its acceleration and rate of climb were refreshing to a lumbering transport jockey.

Takeoff was uneventful and climbout was excellent. We could not go to our flight test area because of weather so I turned south. I found a small clear area and started a 2500 foot per minute climb to 20,000 feet.

As we passed through 9000 feet No. 1 engine failed so the propeller was feathered. With emergency procedures completed we were still climbing at 1000 feet per minute. Since the aircraft was so light I decided to continue the flight.

At 20,000 feet the aircraft was performing very well. The functional checks progressed rapidly and then without warning both the VHF and UHF radios became inoperative. I could still see some clear areas, so the loss didn't concern me too much.

Finally we came to the last thing on our test flight work sheets, prop feathering. No. 1 was already feathered so I feathered No. 2. It checked out so we brought it in and feathered No. 3. It too was good and it was brought back into operation. No. 4 was then feathered but when we tried to bring it in, it would not unfeather. We tried everything. The aircraft could not maintain cabin pressure on two engines nor could we maintain altitude with less than maximum power. That not being desirable, I reduced power, found a clear area and started a slow descent. Meanwhile my crew was trying to find the reason why we could not unfeather No. 4.

As we were descending all of our present problems took a back seat when No. 3 prop started hunting 200 rpm. The engineer tried changing RPM to correct the condition but that just aggravated the problem. The prop began hunting between 400 and 500 rpm and suddenly increased through 2800 rpm. I quickly moved for the feathering button and held my breath. The pump took hold and slowly moved the prop to the streamline position.

Let's see now, three engines out, VHF-UHF radios inoperative, weather and an aircraft which had been light suddenly became very heavy. I and my crew, but I most of all, finally began to see the light. Now I had to continue descending; I had no choice.

I attempted to gather my thoughts. If we descended VFR in the small clear area we were in, we would break out just 2500 feet above the terrain 40 miles south of the airport. Should I order the crew to abandon the aircraft now? What a nut, why didn't I return when the first engine failed?

There was a lot to think about; in fact, I barely heard the electronics technician say he had found a loose wire in the No. 4 prop feather motor timer plug. I pulled out on the button to unfeather the prop. It seemed like an eternity but then the prop began to rotate. We now had two engines running, enough to get us home.

Later I realized that I foolishly thought I was helping my organization fulfill its mission. I now know that fulfillment of the mission with maximum safety is really the goal. ☆

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

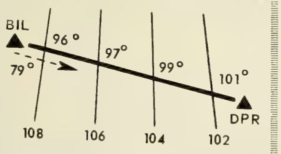
Q. One would expect reciprocal headings on enroute navigation charts to be nearly 180 degrees apart, plus or minus a few degrees for the variation difference between two navigational aids. However, the difference is sometimes five degrees or more after taking into consideration the variation change. Example: Enroute High Altitude Chart (H-1 Northwest) from Billings to Dupree, the variation differential is four degrees, yet the reciprocal headings vary nine degrees. Please clarify.

Colonel R. C. Franklin, Jr., 4520 Combat Crew Training Wing, Nellis AFB, Nevada.

A. The nine degrees variance between the published reciprocal radials at Billings (BIL) and Dupree (DPR) is correct. A four degrees variance is due to magnetic variation. The remaining five degrees are the result of the charts, "Lambert Conformal Conic Projection." Although all VOR radiated signals are oriented to magnetic north at the station site, each radial is measured or extends from the station in a straight line. A straight line, on the Lambert Conformal Projection, approximates a great circle (the shortest distance between two points on a sphere). This line crosses each meridian at a different angle due to the convergence of the longitudinal lines. The accompanying illustration represents the route in question.

You can observe from this illustration that the five degrees variance between the true course at the 108th meridian and the 102d meridian plus the four degrees of magnetic variation equal the cumulative total of nine degrees. These apparent discrepancies in reciprocal radials between facilities on the enroute charts are most prominent on east and west headings at the higher latitudes. From the pilot's standpoint, flying the published radials will maintain a position on a direct line between the two stations. Additional information on these features of Air Navigation may be found in Chapter 2 of AFM 51-40.

MERIDIAN	108	106	104	102
TRUE COURSE	96	97	99	101
VARIATION	16	15	14	13
MAG COURSE	80	82	85	88



Q. Does AFM 51-37 require that a standard rate turn always be used during the traffic pattern phase of a Gyro-Out radar Approach?

Major George Aubry, Jr., 3560 PTW, Webb AFB, Texas.

A. No, standard rate turns should not be used in all instances. The rate of turn in the traffic pattern phase should be three degrees per second, if this is possible without exceeding 30 degrees of bank. Circumstances may dictate deviation from this procedure, e.g., attitude indicator failure, partial loss of available engine power, or very small heading changes where the angle of bank should not exceed the number of degrees to be turned. Except for these, or other circumstances of an unusual nature, the turn rate or angle of bank during a "gyro-out" approach is the same as that for a full panel approach.

POINT TO PONDER. The jet enroute penetration has "come into its own" in the past year. It is being used by Air Force pilots more and more, not only because it saves the pilot time, but because it saves the controller time,

The Air Force pilot should always bear in mind two things regarding enroute penetrations: First, the procedure is an additional service provided by Air Traffic Control and it is not mandatory that the controller honor your request for an enroute penetration. Second, the pilot should in his preflight planning, expect to make the published approach. Then, if his request for enroute penetration is honored, it's just frosting on the cake.

Now, let's look at the enroute penetration and see what's involved.

First, you will be given a clearance limit which will be navigational aid or fix depicted on the FLIP Enroute High Altitude Charts *or* depicted in the appropriate FLIP Terminal High Altitude Charts from which a letdown can be made in case of two-way communication failure.

Second, you will be assigned an altitude to which you are cleared to descend. The descent is based on a rate of 4000 to 6000 feet per minute. The controller determines the distance from the airport where descent clearance should be issued by adding 10 to the first two digits of the flight level. For example, if you are at FL 300 descent will normally begin when you are 40 miles out.

This clearance limit and altitude assignment are the keys to your safe transition from cruising altitude to a point where you can successfully make an approach and landing at your destination. If you can maintain two-way communication in the radar environment, you should have no problem.

Next month we will discuss radio failure during a jet enroute penetration. ☆

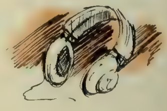
Aerobits

NOT LUCK—At McChord AFB the safety office presents an inscribed plaque, called the Lucky Horseshoe award because of the gold horseshoe superimposed on the front of the plaque. It goes to drivers who were saved from death or serious injury by seat belts. Here's a case in which an Air Force officer and his wife ought to have twin horseshoes, not for luck but for good judgment.

They were driving along in their pickup when suddenly an out-of-control automobile came skidding at them in their lane of traffic. The officer was unable to avoid a collision and crashed broadside into the other car. Result: The officer and his wife received minor injuries; they were wearing seat belts. The driver of the other car was thrown into the windshield and received a severe skull fracture; he was not wearing a seat belt.

THAT ANNOYING SOUND—Before deployment, crews involved were given a briefing which included an audible demonstration of the sound characteristics of the URT-21 personal locator beacon. Later on, the pilots of the flight of fighters were appreciative of this, because one accidentally actuated his beacon. Upon rendezvous the fighter flight lead asked the tanker crew if they had taken a bearing on the guard transmission. The reply was that they had heard the transmission, didn't know what it was, became annoyed with the noise and had turned the receiver off . . . Not a comforting thought, had one of the pilots actually had an emergency, had to eject, and count upon the beacon to lead searchers to him.

Included in the report was the recommendation that crews be briefed on the sound of the beacon and what actions to take. Ever heard the pulsating tone of the URT-21? If not, call your flying safety officer, ask him to locate a tape and play it at the next flying safety meeting. YOU might be the guy waiting hopefully for searchers to locate you.



ONE HUNDRED DOLLARS AN OUNCE—The big, many-motored bird was grounded awaiting a new elevator assembly. (Seems that the one that came on the craft originally had been damaged by a fork lift operator who thought he could drive under the tail section, but couldn't.) Wasn't long tho' before the Supply troops located an elevator and everyone thought that it wouldn't be long before the C-54 would be airworthy again. However, just prior to installation, a real sharp maintenance type was giving the trim tab mechanism a good going over and found that the control cables appeared to be crossed. To make sure his observations were correct, he got out the books and some assistance from a couple of QC inspectors. Sure enough, the tab control cable was wound on the drum so that applied nose-up trim would have resulted in the opposite effect. The drum was removed, rewound, and installed properly. The bird has been making its scheduled missions ever since.

It's sure good to have conscientious maintenance troops like this one around. They're worth their weight in gold!

Hq ATC, Safety Directorate

PASS THE O_2—During flight at 31,000 feet, cabin pressure 25,000 feet, a crewmember attempted to adjust his mask because of blow-by when he exhaled. Unable to make the proper adjustment with the mask attached to his helmet, he removed the mask. Shortly he began to detect symptoms of hypoxia but was unable to get the mask back on before passing out. Fortunately a fellow crewmember noticed his condition and placed the man on 100 per cent oxygen. The pilot made an emergency descent. The man recovered and was later examined by the flight surgeon who determined there were no adverse after-effects.

ERRATIC B-66—The pilot of a B-66 had what appeared to be normal approach and landing until the nosewheel contacted the runway. The aircraft then began a gradual turn to the right, left the runway then began to parallel it. After knocking down several thousand-foot markers the pilot got the machine stopped 5200 feet from touchdown. Drag chute, left rudder and brake were used in an attempt to control the aircraft, but to no avail.

Later it was determined that three different pilots had reported directional control problems on landing roll during four out of 10 flights. They reported the trouble but attributed it to anti-skid, dragging brake, crosswind, but no entry was made in regard to nosewheel steering as the problem. Maintenance inspected the brake, changed a tire and an anti-skid control valve. Because of some reports of intermittent nosewheel steering problems, a microswitch was adjusted and a cannon plug cleaned. Following the incident related, there was a complete teardown of the steering mechanism which revealed frayed and broken wires that control the engagement of the hydraulic clutch connecting the nosewheel steering control to the rudder pedals. This was the primary cause of the incident, but other findings included inadequate pilot writeups and insufficient corrective action during trouble-shooting.

USAF WEATHER WARNING SERVICE. Recent aircraft accident investigation reports indicate confusion among some pilots concerning the USAF weather warning system. Remember, Air Weather Service products are designed to meet U.S. Military requirements both in detailed criteria and timeliness. United States Weather Bureau (USWB) warnings are produced by the Severe Local Storm Center (SELS) and distributed over FAA channels. Air Weather Service warnings are no longer produced jointly with the USWB, although the AWS Weather Warning Central Forecast Facility is still located at Kansas City, Mo.

All CONUS Air Force weather detachments receive graphic weather warnings for the contiguous U.S. four times daily on teletype circuit COMET II. These warnings are amended as required. Spot warnings are issued by the Kansas City unit for approximately 500 ocations. Your weather forecaster uses these forecasts unless local weather conditions dictate otherwise. He is required to brief you on any advisory within 100 miles of your proposed flight plan.

Our weather warning facility has compiled an excellent verification record. The service provided is the best available. Here is a word to the wise. If you are clearing from a base field with limited weather facilities and have any doubts about the weather, don't hesitate to obtain the full weather treatment by using the telephone weather briefing procedure shown in the Enroute Supplement.

In summary, remember the term SELS now applies only to the U.S. Weather Bureau. Also notice that I have not used the word "severe." That term is now used by SELS only. We use the terms: Weather Warnings (a specific forecast) and Weather Warning Advisories (a probable occurrence which serves as an alert that a specific warning will probably be issued at a later time). Lastly, if in doubt, use the telephone. Reference Air Weather Service Manual 55-8.

Lt Col Jerry Creedon
AWS Liaison Officer
Directorate of Aerospace Safety

Aerobits

CLOSED MEANS CLOSED — Two aero club members, one with a private ticket and the other a student, were seriously injured when their light aircraft caught a wire with the gear during an attempted landing. No, this was not a low drag-in approach into the wires. The runway was closed and contained obstructions. (Incidentally, this landing was a violation of AFR 34-14 which sets criteria for airports at which an aero club aircraft may land.)

IMPROPER PROPPING—There are several ways to prop an engine: the right way and all of the wrong ways that can be devised. For example, an aero club member received serious injuries when he placed one hand on one blade, the other on the remaining blade and spun the prop. The engine fired and one of the blades struck the man in the leg.

We're not going into the proper way of propping an engine here because we don't believe this procedure is really necessary. The mishap related occurred because the lad tried to prop an aircraft that had a dead battery. Change the battery or hook up to some external power. No aero club flight is so urgent that hand propping is necessary. ☆

FALLOUT continued

The Base Operations Officer should have evaluated the serviceability and condition of the runway. Air Traffic Controllers disseminate the Base Ops officer's reports to aircraft intending to land or take off. The Base Operations Officer—not Air Traffic Controllers—has the authority to close and open runways.

MSgt Rudolph H. Stamm
2052 Comm. Sq, AFCS
Keesler AFB, Miss.

Thank you for the suggestion. As stated in the article, this case occurred in Canada; their procedures may differ.

ROUND TABLE ON GUARD

I must take my hat off to you gentlemen. The September 1964 issue of AEROSPACE SAFETY prompted me to write and I hope you'll bear with me if I've cluttered your IN basket.

These comments are directed to the Round Table discussion on Guard Channel misuse (pages 8 and 9, Sept. 1964). I consider myself fortunate in having flown daily in the old Chicago-Indianapolis Pathfinder area and growing with them. Apparently, that area was chosen to implement positive control because of its dense traffic. I personally feel that the FAA has gone completely overboard to assist and give service to the buck pilots. With the exception of certain geographical areas, FAA's capability is only hampered by cockpit short circuits (between headset).

I am convinced that in this area, major misuse of Guard frequency exists and, further, there is little change whether the sky condition is VFR or IFR. I have submitted OHR's against the Fort Worth Center plus military aircraft and some other ground stations. My flying is confined to target aircraft for pilots undergoing F-102 training. I will be the first to admit that I do not continuously monitor Guard frequency. I cannot afford to, since I must break off the fighter or take evasive action at his 15- or 20-second-to-fire transmission when he has an improper setup. Many times I have switched to T/R position in order to hear the fighters' 15/20 second transmission, and I am the one who must take evasive action as the fighter is monitoring Guard. Note taking during flight as target aircraft shows an average of 10 Guard transmissions per two hours of flight.

Our FLIP, AFR's, FAA-FAR's, ATC, etc., very clearly define procedures for lost communications. Aircraft equipped with transponders really have no emergency, should they lose their transmitter. The FAA can, on second call, ask for an "IDENT" acknowledgment; it can assign another frequency in the same manner, asking for an "IDENT" acknowledgment, etc., on each change. If the pilot(s) have turned down their volume then centers, radios, etc., transmitting on Guard is rather useless. Should ATC receive no acknowledgment to "IDENT," then one Guard transmission assigning a frequency and requesting an "IDENT" acknowledgment would suffice. VOR/TAC radios are another means of relaying to the pilot. I have used the above procedures under cruddy IFR conditions in the NE and north and they work very well. Of 17 years rated duty I have yet to make my first Guard transmission. If it's a case of an aircraft with complete electrical failure, well — best of luck!

With the gate hold, positive airspace, and lost communications procedures there are really no problems. In addition to these procedures, four things that could go a long way toward streamlining military/civilian air traffic would be:

- Lower the positive control airspace to 16,000 feet for the entire United States and the continental control zone down to 10,000.
- Require all military pilots to attend instrument academic refresher courses every six months and revise the written examination to cover more on IFR emergency procedures, departure, en route and arrivals and administer written examinations every six months with a minimum acceptable score of 90 per cent. This score is high; however, if the pilot does not know what to do then best we do not expose him.
- Implement procedures for "IDENT" for apparent transmitter problems.
- If repeated calls on assigned frequency plus a Guard call do not give contact with the pilot, then a call to the Watch Supervisor or an RBI, might be in order, especially if the pilot finally comes in out of the blue as if nothing had happened.

This letter might seem a little on the negative side and I'm afraid it is, but it's certainly disgusting to sail along listening to Guard chatter when we have procedures to employ, except for flameout or complete electrical failure and for the latter who can help. Best of luck as you pursue to solve this problem; in the meantime I'll be listening on T/R + G.

Maj Thurman B. Sykes
4780 Orgl Maint Sq
Perrin AFB, Texas

WELL DONE

Flt Lt DAVID W. PARSONS

314 TROOP CARRIER WING, SEWART AIR FORCE BASE, TENN.

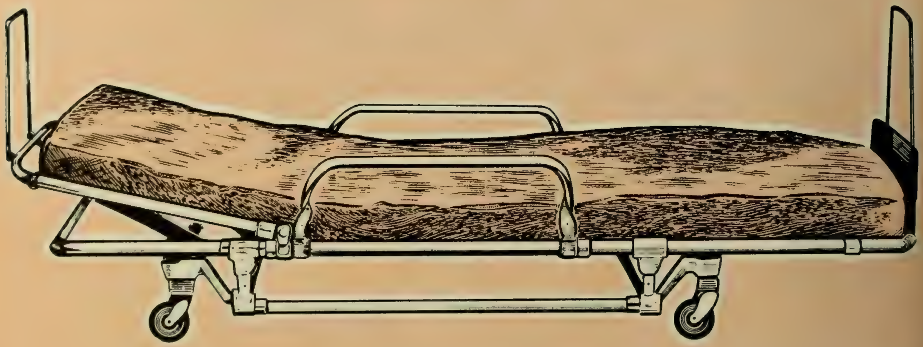
Flight Lieutenant David W. Parsons, RAF, has received the USAF Well Done Award for the manner in which he handled the following emergency. He was flying a C-130 at 19,000 feet when the forward cargo door blew out, causing explosive decompression, loss of the major oxygen systems and a large portion of the fuselage. An airman, seated near the blown door, was sucked out and fell to his death. The door and large pieces of the torn fuselage struck the number one and number two propellers, the right horizontal stabilizer, and caused grave damage to the number two engine.

Flight Lieutenant Parsons immediately feathered the propeller on this engine but only three of the four blades went into the feathered position, thus causing violent vibration. Several hydraulic lines were torn loose, filling the aircraft with hydraulic fumes and fluid, and rendering the normal braking, landing gear, and flap extension systems inoperative. Flight Lieutenant Parsons immediately took the prescribed action for an explosive decompression. The copilot, in addition to helping fly the aircraft, notified Air Traffic Control of the emergency and coordinated the radio calls.

The first navigator accurately fixed the position of the aircraft, which later greatly assisted in recovering the airman's body and the missing aircraft parts. He then directed the aircraft to the nearest safe emergency airfield. Additionally, he monitored terrain clearance throughout the descent and greatly assisted the pilot in flying the traffic pattern with the airborne radar. The second navigator and the loadmaster, at considerable risk, crawled past the gaping hole to the rear of the aircraft and passed parachutes forward for the rest of the crew. The flight mechanic and the crew chief also went aft, diagnosed the damage to the hydraulic system and manually extended the main landing gear and the flaps.

Flight Lieutenant Parsons determined that the aircraft was controllable above 150 knots airspeed and flew it to a safe landing. His decision not to abandon the aircraft near heavily populated areas and his crew's subsequent handling of this emergency reflect great credit upon him, the Royal Air Force, the United Kingdom and the United States Air Force. WELL DONE! ☆

DON'T GET CARRIED AWAY *



* BY CARELESSNESS

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AEROSPACE SAFETY

UNITED STATES AIR FORCE

APRIL 1965

AEROSPACE SAFETY

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AFRP 62-1 APRIL 1965 VOLUME 21 NUMBER 4

FALLOUT

HIGH TERRAIN LIGHTS

Regarding the article "How Could I Happen?" (January issue), a possible solution would be the installation of lights o the high terrain surrounding the airport.

Col Joseph E. Duval
DCS/Research & Developmen
Headquarters, USAF

RADIALS AND MAG HEADINGS

Col James G. Fussell's letter (January regarding Radials and Mag Headings sound to us like a letter from home. Like so man people we have found it easy to beef abou the system but haven't taken the effort t do anything. We have all had problem identifying a radial, intercepting it, correctin to course and relaxing to the point wher we thought "I'm going to make it down yet, when that radar controller asks us to "squaw flash" and cooly informs us we are 18 degrees out!

We, as fighter pilots (or so we like t think, even though we suddenly find tw big engines and two pilots in the F-4) kno what it is to dig out that chart when thing don't go just as planned. Even with tw guys it's tough in the confines of a fighte cockpit and too time consuming. If we ha known what direction to go in the firs place, i.e., a mag heading, the rest of th gyrations would not have been necessar

One other little thing: Somebody, some where, figured out one of the finest naviga tion instruments known to man. They calle

continued on page 28

ABOUT THE COVER

Artist's brush catches crewman about to enter water. Article on pages 16 and 17, and first hand account on back cover provide latest survival information.

Z-D *AND YOU*

We've heard a great deal during recent months about a program called Zero Defects. This is an effort to improve quality and reduce costs through the elimination of human error. Industry has applied the principles of Zero Defects and AFLC has a big Z-D program going for the Air Force.

The idea of reducing defects in workmanship or performance is, of course, dear to the heart of everybody in the safety business. If there were some way in which we could eliminate human errors on the production line, the flight line, in the cockpit or in the shops, think what this would mean in the preservation of lives and equipment. The monetary savings would certainly be spectacular and the capability of the Air Force to carry out its missions would be enhanced.

Several examples have come to my attention lately of work defects that caused accidents. An F-100 crashed because a bolt came out of the rudder control linkage. The bolt wasn't safetied. We've had this sort of thing before.

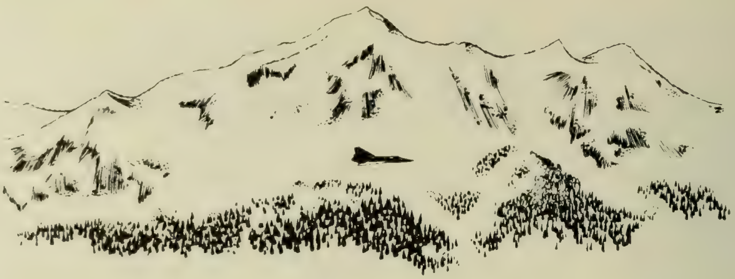
Debris left in aircraft components during routine maintenance and overhaul has done its dirty work. A fighter pilot recently could not keep the aircraft on the runway, it veered to the right. When the aircraft left the hard surface the gear collapsed. A small piece of safety wire had been left in the nose wheel steering mechanism during IRAN. This caused a spurious signal which the pilot could not overcome.

Last year the Air Force had 298 major aircraft accidents; 262 aircraft were destroyed. We lost four ballistic missiles, not to mention a lot of air launched missiles. There are a few of these we can't explain, but we're pretty sure of what happened in most cases. As the evidence is sifted during an accident investigation the area of uncertainty begins to narrow. Pretty soon cause factors begin to come into focus and finally a basic cause is proved. Too many of these accidents stem from human omission or commission. Eliminate these deficiencies and we can preserve lives and eliminate unnecessary aircraft and missile losses.

I see the Z-D program as a personal thing. Years ago we might have called it "pride of workmanship." I wish every person in the Air Force who has anything whatsoever to do with any of our weapon systems would adopt Z-D as a personal philosophy. If each of these people took stock of himself and pledged to provide defect-free work, the benefits would be tremendous. Why not give it a try?

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety



LOW DOWN CAT

By Captain R. C. Grazier, Aeronautical Systems Division

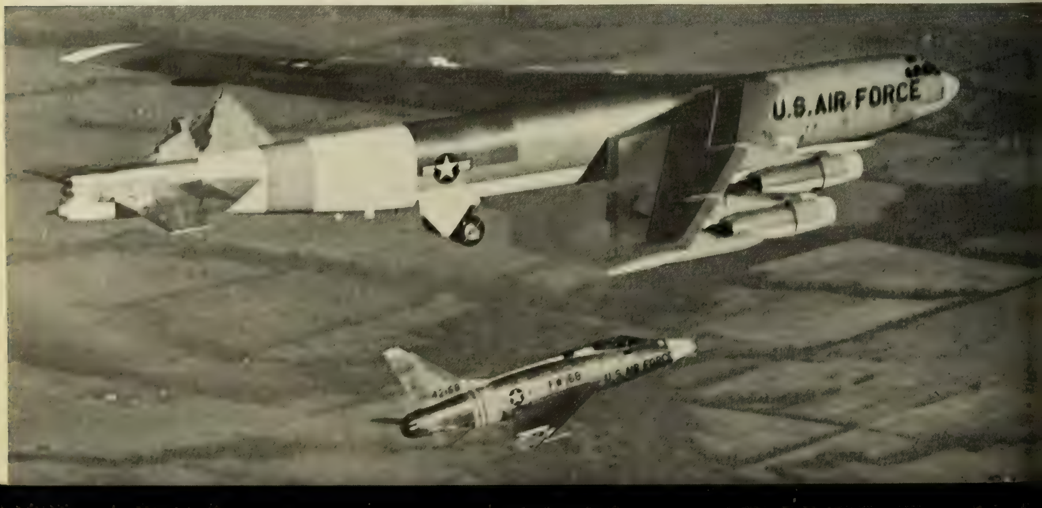
Adapted from a paper by Captain Grazier, and F. K. Atnip, Senior Group Engineer, The Boeing Co., presented to The Society of Expeimental Test Pilots.

The aircraft with the stabilizer missing is a B-52H test airplane after a CAT encounter ("Something's Missing," AEROSPACE SAFETY Magazine, April, 1964). The airplane was highly instrumented to measure the response of the airframe to turbulence at low-level—not to measure stability, tail off.

At Wagon Mound, New Mexico, the airplane had turned and begun its northbound course alongside and east of the Sangre de Cristo Mountains. The turbulence environment progressed from light to moderate and the pilot was forced to climb to a higher altitude. As the airplane passed through 14,000 feet, the air became very smooth. The airplane was accelerated to 350 knots, in preparation for the next test condition, and lunch was being contemplated by the crew. As the airplane passed adjacent to East Spanish Peak, located near Walsenburg, Colorado, a large discrete gust, of sufficient magnitude to fail the vertical tail, was encountered. From instrumentation on the airplane, the gust velocity was calculated to be on the order of 120 feet per second. The next questions were: "How frequently can we expect to encounter gusts of this magnitude? Why do low-level gusts differ in shape from classic gust models? What is the origin of such gusts? Can the weather systems and terrain effects associated with this phenomenon be identified?" To find out, a test project was set up.

The aircraft selected for the project was F-106A 56-0455. No doubt, there are several of you who have flown the 'ole girl.' It is my understanding that she has been in the loads-measuring racket since she was first put together by Convair. She looks like an ordinary F-106 from a distance, say a strong 7 iron; however, closer inspection will reveal that it's really an F-106 shell, housing a maze of instrumentation.

The instrumentation is basically a narrow band-frequency modulated tape system. The tape deck is fed information from a differential pressure gust probe mounted on the nose boom; Statham strain-gage-type accelerometers mounted on the nose, tail, and c.g., and a gyro-stabilized platform. All data were time correlated and supplemented by a voice track on the tape. We recorded time, position, weather, and all radio conver-



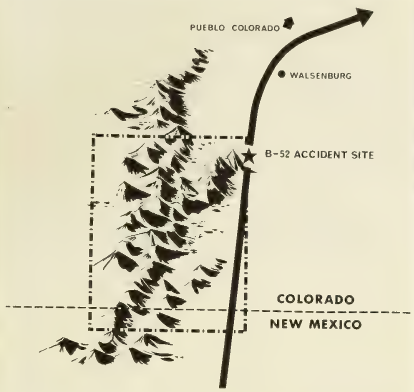
sations. An F-100 was selected to be flown by Boeing pilots to serve as a pace and chase as well as for photographic support.

OPERATIONS AND DATA COLLECTION

Aeronautical Systems Division collaborated with the Boeing Company to form a 14-man task force to set up a remote operation. The operation was established at Kirtland AFB, New Mexico, because of their F-106 support capability, tape readout facilities, airline shipping facilities (data tapes were returned to Boeing daily), and mainly because of its proximity to the test area. The area extended from Las Vegas, New Mexico, in the south, to Pueblo, Colorado, in the north, along the Sangre de Cristo Mountains. This geographical area was selected solely because it was where the B-52 had lost its fin. Specifically, the vertical fin had been lost adjacent to the East Spanish Peak near LaVeta Pass. There are perhaps many other locations even in the United States which would yield sharper turbulence. Two examples might be near Bishop, California, or in a thunderstorm anywhere. The Bishop area has experienced winds strong enough to lift a P-38 15,000 feet with both propellers feathered. Also, we have measured gust velocities greater than 300 ft/sec in the thunderstorms in Oklahoma. Wind velocity, however, constitutes only one ingredient in the recipe for destructive turbulence. The gust must also have a sharp profile to produce aircraft bending forces. The test results strongly verified the validity of our choice of the test location.

Our initial operational concept was to maintain our aircraft in a state of readiness and launch when, according to the weather observers, the atmospheric conditions were right for gusts. We found the gusts to be so unpredictable that we flew at least one mission each day, regardless of the turbulence reports or forecasts. We found the conditions necessary for extreme turbulence are much more complex than just a strong wind blowing over a mountain ridgeline. Mountain wave formations result from rare combinations of meteorological and topographical conditions. Two of the three times when we found evidence of such wave formations, we made quick refueling and instrumentation turnarounds; however, by the time we got back into the area, they had dissipated. So generally we flew twice a day, whether the conditions looked favorable or not; and, in retrospect, I believe this to be the wisest method of operation. The results were 59 data flights flown for a total of 89 hours, from 7 March to 28 April 1964.

When mountain waves form they contain a core of turbulence. There are also wave reflections extending to the tropopause, random low-level turbulence extends from the ridgeline downwind for 15 to 20 miles, and a mechanical type turbulence exists a few yards from the ridgelines. We found that ridgeline turbulence formed much more readily than the actual mountain wave. We had decided that our primary purpose was to get hit by the strongest, sharpest gust we could find. The project was therefore oriented to seeking out the core of turbulence, if we could find one, but more often than not, we had to settle for the mechanical turbulence. To accomplish this objective, we flew downwind from and adjacent to the sharpest ridgelines in the area. The original plan, as I mentioned, was to use an F-100 as an escort and pace support aircraft. Experience quickly revealed that the aircraft should work as a team, seeking out the turbulence and defining its boundaries. In fact, without the F-100, much of the mountain wave profile information would have been unattainable. Although we found more turbulence than we ever anticipated, we encountered only three mountain waves during the 89 hours of flying. Since our purpose was to measure the big bumps, we certainly couldn't afford to expend valuable data time flying in other than the most violent area; so, while we put the F-106 in the turbulence, the F-100 flew patterns to define the top, bottom, and relative intensity of the turbulence in the vicinity. I'd like to add here that the companionship of a friend while getting slammed around those rugged, wicked looking, sharp, snow-covered, desolate ridgelines provided a most pleasant peace of mind.



Dark line indicates route of B-52 which lost portion of tail in turbulence at "★". Bomber turned east and eventually landed safely at an alternate airfield. Box is area of CAT search by F-106-F-100 team.

AIRCRAFT CONTROL

Aircraft control consisted of the task of maintaining straight-and-level flight at as near a constant airspeed as possible. Three-hundred and fifty knots was chosen as a compromise between aircraft control and optimum instrument response. Gyro precession and the simplicity of small angles in data reduction made it desirable to have the aircraft straight-and-level when hit by the gusts. The difficulty of the task can be appreciated when you consider that we were trying to fly only a few yards from a twisting ridgeline, maintain straight-and-level flight as much as possible, and in turbulence which, at times, nearly surpassed control authority.

Project F-106 flies low in mountains during clear air turbulence search.

CAT INDICATIONS AND FINDINGS

Thunderstorms warn the pilot of the danger in many ways. But clear air turbulence (CAT) is like a ghost, you can only sometimes see the associated signs of its presence. The only dependable indication of clear air turbulence in our test area was snow blowing off the mountain tops and the ridgelines. It looked like a blowing tassel on a huge white cap. We always experienced turbulence flying adjacent to a ridgeline if the snow was blowing. Extreme turbulence was encountered if the snow was being lifted up through the trees on the downwind slope. Obviously, this indication of turbulence vanished with the snow. Generally, as the wind velocity increased, so did the mechanical ridgeline turbulence. The mountain waves did not present such a simple indication. We did on occasion observe the classic roll and lenticular clouds. However, on one mission, we encountered a severe core of turbulence without a cloud in sight.

Although we investigated and searched 200 miles of mountain range, the most violent turbulence was consistently found adjacent to the ridge where the B-52H lost its vertical stabilizer. Several distinct characteristics may be noted about this ridge:

- It's oriented perpendicular to the prevailing westerly winds.
- The ridgeline is composed of an unbroken series of peaks and saddle-backs extending for almost 20 miles at nearly constant altitude in excess of 13,000 feet.
- The topography of the western slope is an essentially flat desert floor, allowing the wind an unobstructed path for 50 miles.
- LaVeta Pass terminates the ridge on the north end and provides a channel for possible wind flow around the ridgeline.

Each characteristic seemed to be part of the ingredients necessary to produce aircraft-bending forces.

The rotors that we found were all located six to ten miles adjacent to and downwind of the ridgelines. The core of turbulence paralleled the ridgeline and appeared to be about 2000 feet in diameter. The top of the core was just below the ridgeline altitude where there was a sharp boundary of smooth air. The core seemed to dissipate where the ridge turned away from the perpendicular to the wind. The core also seemed to dissipate with higher wind velocities. Other ridgelines in the area looked sharp enough; however, daily investigation failed to reveal the formation of this core of turbulence. Obviously, severe turbulence is found only under very special conditions. It is evident that both wind direction and speed, as well as the orientation and particular characteristics of the topography, are extremely critical factors. Although there were several visual indications of turbulence, we found no parameter, visual or otherwise, which will guarantee a valid forecast of turbulence intensity.

GUST EFFECTS

The physiological effects of the gusts on the pilot were not recorded; the psychological effects were also not recorded, but I can assure you the experience will remain with us for some time. The aircraft was instrumented, we were not. The aircraft was stressed for the gusts, we were not—at least not too well. Human factors do, however, constitute a significant part of aircraft design and should always be considered. I don't intend to formulate any conclusions with respect to harness design. Also, my intention is not to predict what you might feel if you encounter the same turbulence in any other type air machine. I would, however, like to relate a few of the sensations and problems so that you can get a better picture of the effects.

In the spring of 1963, I served as project pilot of an instrumented F-100F for the National Severe Storms Project "Rough Rider." In that capacity, I penetrated 53 mature thunderstorms to collect meteorological data. Although we got slammed around quite a bit in the thunderstorms, the turbulence was never as rough as the clear air turbulence encountered during this project. When an aircraft is pounded by gusts, the pilot gets tossed around inside the cockpit. You can be strapped down only so tight and still retain the mobility required to function. Positive control of the body was sometimes extremely marginal. For instance, we found that if we held the throttle as in a normal flight position, the result was continual, unintentional, power changes. As a consequence, we had to position the throttles, brace ourselves as well as possible, hang onto the stick, and ride it out like a bucking bronc.

The problems can be divided into those resulting from lateral and those resulting from vertical gusts. A lateral gust striking the aircraft resulted in a rolling moment. The resultant bank and acceleration caused a lateral motion of the body, and our helmets would slam against the side of the canopy. The lateral gusts also flexed the vertical tail a bit. Most of the F-100 pilots adjusted the rear view mirror so that they didn't have to see the bending. They said that they just preferred not to watch it. The vertical gusts resulted in fatigue, a sore back, poor voice control, and an ejection hazard. We found it difficult, and sometimes impossible, to talk coherently when riding out the severe turbulence. The sharp, high G gusts did an excellent job of scrambling up syllables. On one occasion, my ejection handle was partly raised by a large negative gust. I completed the remainder of the project with the seat pin installed. It was impossible to tighten the lap belt enough. One time, one of the F-100 pilots was thrown up from the seat and came down with his seat cushion survival kit wedged against the stick. Additional negative gusts assisted him in working it back into place. The combined gust effect raised havoc with aircraft electronics. Compass systems, UHF radios, and TACAN sets were replaced regularly. One time, a radio specialist remarked, "it looks like someone stuck his foot through the amplifier." Power supply and other system failures had to be taken in stride; however, the illumination of a warning light is always distracting. Structurally, the aircraft remained sound. Visual inspections revealed only a few popped rivets at the base of the vertical fin.

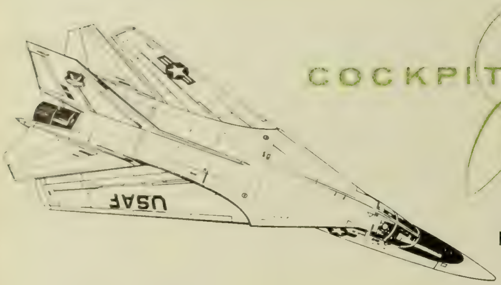
Naturally we did not encounter 100 feet per second gusts on all flights, but we did get hit by gusts over 100 feet per second several times. Quite often we flew in turbulence containing 40-80 feet per second gusts. Considering the airplane dynamics, this meant that we were getting slammed with sharp 2 to 4 G raps and quite a few of those 5 to 7 granddaddies. Maneuvering load factors of 3 or 4 G are quite common to a fighter pilot. The uncomfortable aspect of turbulence flying is in the fact that gusts start the body moving in one direction before jerking it in another. The load factor caused by one of the larger gusts transitioned sharply from -2 to more than +5 G. That adds up to a 7 G differential.

CONCLUDING REMARKS

We searched, found, and measured turbulence powerful enough to destroy aircraft. The season for severe turbulence was supposed to have been past; however, the quantity, shapes, and magnitudes of the gusts that we encountered during our brief, limited investigation were astounding. No one anticipated gust profiles that were so sharp edged, and certainly not gusts which would yield a rap of a 7 G differential.

Gust probe (left) mounted on nose boom of F-106 fed information to tape deck mounted in 455, project F-106A.

Before the program was two weeks old, the preliminary data had convinced engineers making studies of advanced low-level weapon systems that their design requirements would have to be more stringent if these aircraft were to survive a reasonable lifetime. Other engineers making studies on modifying present weapon systems to increase low-level capability also revised their modification criteria. Certainly, all Air Force design criteria will NOT be rewritten based on two months of turbulence investigation in one geographical area; however, it points out the need for much more knowledge of the low-level environment, and this program proved the feasibility of obtaining it. It will bring about improvements in the present state-of-the-art in flight gust measurements. Boeing is now designing and fabricating a new gust probe instrumentation system. Our project has prompted a proposal for a more detailed program which will allow us to construct an analytical model of the gust environment. Also, a request has been submitted to conduct physiological studies on the effects of extreme turbulence on the respiratory, cardiac, and neurological body functions. ☆



COCKPIT Design by DORA

By David V. Lewis, General Dynamics Fort Worth

As the jet fighter touched down, the pilot reached for the drag chute release handle. At least he thought he did. Instead, he pulled the emergency gear-up handle. He was fortunate to escape without serious injury, but an expensive aircraft was damaged.

Others have not been so fortunate. Records reveal a history of similar accidents and near-accidents for this type fighter. Reason: poorly placed controls for the emergency gear and drag chute. They were so arranged that it was easy for the pilot to make a mistake.

Poor cockpit arrangement—mostly inaccessible or easy-to-get-confused controls—has resulted in many mishaps in the past. Therefore, why not design the cockpit around the pilot rather than fit the pilot to the cockpit? In this way, engineers hope to discover and correct potential cockpit problem areas on the ground rather than in the more crucial flight environment.,

This approach was carried out on Uncle Sam's newest fighter, the sweep-wing F-111, now being tested at Fort Worth Division of General Dynamics.

The device used was DORA (Dynamic Operator Response Apparatus), a computerized, simulator-like device on which representative Tactical Air Command and Navy pilots "flew" hundreds of missions before the first production plane rolled off the line.

Each pilot flew a wide range of missions—high and low level, reconnaissance, ferry, attack, and so forth—in order to evoke the widest possible range of responses.

"In each series, we were careful to program identical flights for each pilot to insure statistically correct results," says Chet Zimmerman, GD/FW design group engineer, under whose supervision DORA was designed and constructed,.

Unlike an ordinary simulator, DORA is equipped with an elaborate tape-recording system which sets down every switch or lever actuation a pilot makes on the cockpit panel. From this wealth of data, analysis of human reactions contributed to the cockpit's design.

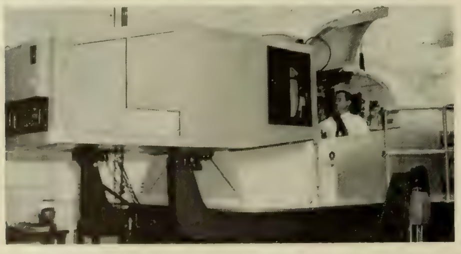
DORA uses a modified Link Mark I solid-state digital simulation computer. Major components include separate crew stations for the F-111A and F-111B, a motion system for the cockpits, a visual system, a recorder system and radar simulation equipment.

An ingenious eye-camera, which pinpoints a pilot's visual fixation at any given moment, is also part of DORA. The camera is synchronized with the recording to both stimulate the pilot and provide resulting pilot-action data.

The visual display system gives the pilot an image of the terrain over which he is flying on virtually any type mission. It is in two parts: a newly acquired Air Force SMK-23 simulating system for on-the-deck sorties, and a series of photographic plates for all other type missions.

When plates must be switched to effect a rather sudden change in flight environment, the pilot simply flies through "haze" for about 30 seconds. Plates represent areas of varying size. The high-level photo-

GETTING READY. S. W. Nichols, design engineer, helps ready DORA for Navy "flights." Pictures of terrain over which pilot is flying are sent through box-like visual display system in front of cockpit.



LOW LEVEL. Television camera, left, transmits pictures of simulated low-level terrain depicted on foam-rubber strips 14 feet high which revolve mechanically.

graphic plate, for example, represents an area about 50 miles across. The lower-altitude plate covers only about five miles.

The amazingly realistic portrait of terrain that DORA crewmen see during on-the-deck missions below 500 feet is actually three strips of foam-rubber mountains, valleys and fields. Each strip, 14 feet high and four feet across, represents an area about 70 miles long and 10 miles wide. The strips revolve mechanically. As they do, a television camera, backed by banks of fluorescent lights, records the movement. After viewing one strip, the camera moves over on a track to the next strip. The result is a virtually uninterrupted low-level flight of considerable distance.

All pictures appear in black and white except those simulating Navy landings. Carrier landings include red and green color to simulate the Navy's "meat ball" system of telling the pilot whether he is above or below the desired glide slope.

The eye-camera is attached firmly to the pilot's helmet. It moves as the pilot's head moves and records his visual world on a hooked-in television setup.

Attached to the camera and extending down like an optical periscope is a metal tube with a small light at the bottom. This light is bounced off the eyeball and projected on to the instrument panel. Here it is picked up by the same head-mounted camera that picks up the overall scene.

Thus the television picture will display both the pilot's immediate area of vision, plus the reflected spot on which his eyeballs are fixed. As the pilot glances from one object to another in the scene, the eye marker jumps rather like an illuminated pointer, always indicating the area of immediate interest.

Geared to the programmed flight, the eye-camera can tell engineers whether the pilot was looking at the right place at the right time, especially at critical points in flight.

Data obtained from DORA are constantly being analyzed and should the data reveal a poor or marginal design, the error can be corrected at a relatively early stage in the airplane's development — long before Air Force and Navy pilots get behind the stick of a production plant. ☆

SEEN THROUGH A FOG BRIGHTLY

Reprinted from Flight Safety Focus

There have been several recent occurrences of accidents caused by loss of visual reference at a critical stage of an approach. These accidents have occurred to pilots whose experience, it might have been thought, would have safeguarded them from this particular hazard. The following report may make clearer the dangers of this situation:

"Before taking off on a night flight to an aerodrome some 50 minutes flying time away, the forecast visibility at destination was given as 1 to 2 n.m., reducing to 1600 yards. Fourteen miles from the aerodrome and at a height of 3000 feet the runway and approach lighting was as clear as crystal and belied the 'actual' then given as 'wind variable 4 knots, visibility 1000 yards.' Scattered patches of thin fog or possibly low stratus had been noticed during the last part of the flight and a 'smear' lay over the approach lights and the first 3000 feet of the runway lights in the landing direction 23. However, there was very little apparent difference between the intensities of the lights at either end of the runway and a visibility as low as 1000 yards seemed rather surprising.

"It was still more surprising when, on reaching the holding pattern a few minutes later, a Runway Visual Range (RVR) of 100 yards was given for runway 23, quickly followed by 50 yards. All the lights at the 23 end could still be clearly seen, the only danger signal, other than the reported RVR, being a slight diffusion of the lights which caused some reduction in the sharpness of individual lights as compared with those at the opposite end (05) of the runway. Air Traffic Control were most helpful and went to the 05 end to check conditions there, while we made an approach to 250 feet on 23 to see what it looked like. Throughout the approach and overshoot, all lights again appeared perfectly clear, despite the 50 yards RVR. ATC's report on the 05 end was that the visibility still remained at approximately 1000 yards along the first few thousand feet of runway. In view of the light wind and the relatively short run required for the twin-engined aircraft being flown, it was decided to land on 05. A visual approach was made and it was not until we were about 200 feet on the approach that the runway lights at the far end of the 10,000 foot runway began to disappear from view in the fog. In the last stages of the landing run, extended with ATC permission so that the full fog conditions could be experienced, all doubts about the reported RVR were dispelled when the visibility reached the stage at which it was only just possible to see one high intensity runway light ahead.

"This was a text book example of just how easy it would be to be misled by what can be seen from the air when there is a thin layer of fog about and a good illustration of why these conditions have led to accidents. Approach and runway lights were clearly visible at least down to 200 feet with only light diffusion as a warning—and yet there was an RVR of 50 yards." ☆

Safety In Combat

By Lt Col Frederick C. Blessé, Directorate of Aerospace Safety

Ever since the first air to ground gunnery and bombing range opened for business, the fighter pilot's major problem has been to estimate range and dive angle. Dive angles in excess of 50 degrees have proven to be hazardous and invariably take their toll of pilots during high angle bombing training.

Unfortunately, experience tells us that the steeper the dive angle the more accurate the bomb—providing the range at which the bomb is released is accurate. Countless training missions must be flown bombing a target with a circle of known dimensions before range estimation is even moderately accurate. The transition from training missions of this type to combat where no circle is available, terrain is irregular, weather uncertain, and flak bursts are apparent again gathers its toll of pilots too eager, too inexperienced, too distracted, or too determined.

Experience in three wars shows us conclusively that combat losses due to pilot error in judgment invariably approach and frequently exceed those resulting from enemy action.

A fire control system is being tested that could revolutionize all this. This system employs laser radar for ranging against ground targets. From a pilot's standpoint it works like this:

1. Put the pipper on the target.
2. Press the weapons release button.
3. Begin pull out.

Sounds too simple? Certainly it does. That's the beauty of it. Putting the pipper on the target is your way of identifying the target to your sight. When you hit the release button, you have told your system, "Drop the weapon on that target when we get to the right range and pull up angle." As the aircraft reaches the precise point in space that will allow the weapon to hit the target, the weapon releases. The system is capable of high or low angle delivery—nuclear or conventional, bomb or rocket (or guns). A laser radar should offer good performance at angles below five degrees as a result of its extremely narrow beam, whereas the returns of a conventional radio-frequency radar might be swamped by noise at angles of only 10 or 15 degrees. Regardless of angle of approach to the target, pilot procedures remain the same. The only limitation is that, by design, the attack system is suitable for weapons delivery under visual conditions only, when performance of the laser radar would not be subject to degradation due to foul weather.

The safety implications of such a system are tremendous. The number of training missions could be reduced because weapons delivery methods could be standardized. Training and combat missions would be identical, reducing losses of new pilots in the combat area. Combat effectiveness, because of overall accuracy in delivery, would be increased, reducing the number of combat missions necessary to destroy a target. Combat losses would decrease because pilots could employ tactics and procedures which reduce exposure to enemy gunfire.

Here's a device worthy of a little prayer from the wife of every fighter pilot in the business. The system is in being, tests are scheduled—we in Safety hold our breath and hope it works as designed. ☆

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q Define a TACAN "Gate".

A A TACAN "Gate" is the final approach fix on the TACAN approach. It is a compulsory reporting point and is also used as a fix for transition to radar or ILS. Level-off from the penetration should be accomplished to place the aircraft over the TACAN "Gate" at the published altitude and at the appropriate airspeed. If an approach is going to be made from the Gate, the final aircraft configuration should be accomplished at or prior to arrival at the gate. Weather conditions will determine the configuration and airspeed to use on final approach. Check your flight manual for this information.

Q Suppose an approach procedure has a restriction stating ". . . complete penetration turn at 3000 feet within 25 NM." Final approach fix altitude is 2000 feet. When may you descend to 2000? *(Captain Robert J. Chepolis, 3510 FTS, Randolph AFB, Texas.)*

A Unless otherwise stated on the FLIP terminal chart, you may descend to the final approach fix altitude when you are established on the inbound course.

Your obstruction clearance will be 1000 feet, five NM either side of the inbound course, until you reach the final approach area. This area starts 10 NM prior to the final approach fix and provides a 500-foot obstruction clearance. It is 4.34 NM either side of course at 10 NM and narrows to 1.25 NM at the final approach fix (VOR). JAFM-55-9 is the reference for this criteria.

Q Should the holding pattern sketch, depicted on a FLIP, Terminal, High Altitude chart, be used? *(Captain Robert D. Poff, Det 27, USAF Air Station, MAAG, APO 205, New York, N. Y.)*

A The RT and LT sectors of the sketch may be used to determine the direction of turn to enter the holding pattern. However, the use of the teardrop entry procedure in the TD Sector is not required. The teardrop entry may be used at the discretion of the pilot. For the current holding pattern entry procedures, refer to FLIP, PLANNING, SECTION II.

POINT TO PONDER

We saw last month what a jet enroute penetration is and what is involved in the clearance that you receive. The purpose of this procedure is to move the aircraft from an enroute altitude to the final approach course without using all the maneuvers depicted on the FLIP Terminal, High Altitude Charts. Normally, you will be given a clearance limit, an altitude, and a vector to either the final approach course or GCA final.

Make certain in your own mind what facility you are expected to use for an approach if you lose two-way radio communication. The controller will normally give you this information by stating a clearance limit fix or by telling you what the radar vectors are accomplishing. An example of the latter would be radar vectors to the ILS final approach course. In either case, if you are uncertain, ask the controller or tell him what facility you will use if you lose contact. After receiving this information, what are you expected to do if you lose two-way radio communication?

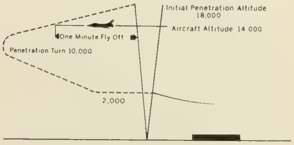
First, check the FLIP Terminal, High Altitude Chart, which depicts the penetration procedure for your assigned clearance limit. Check the minimum safe altitude and descend to your assigned altitude or the minimum safe altitude, whichever is higher. (Refer FLIP, Planning, Section II, Jet Enroute Penetration.)

Second, proceed via the route specified in the clearance, or if none was specified, proceed directly to the assigned clearance limit and execute the published approach procedure.

FLIP, Planning, Section II does not elaborate on how you should perform the published procedure. We feel that the following technique should help you get safely on the ground without using up too much time or airspace.

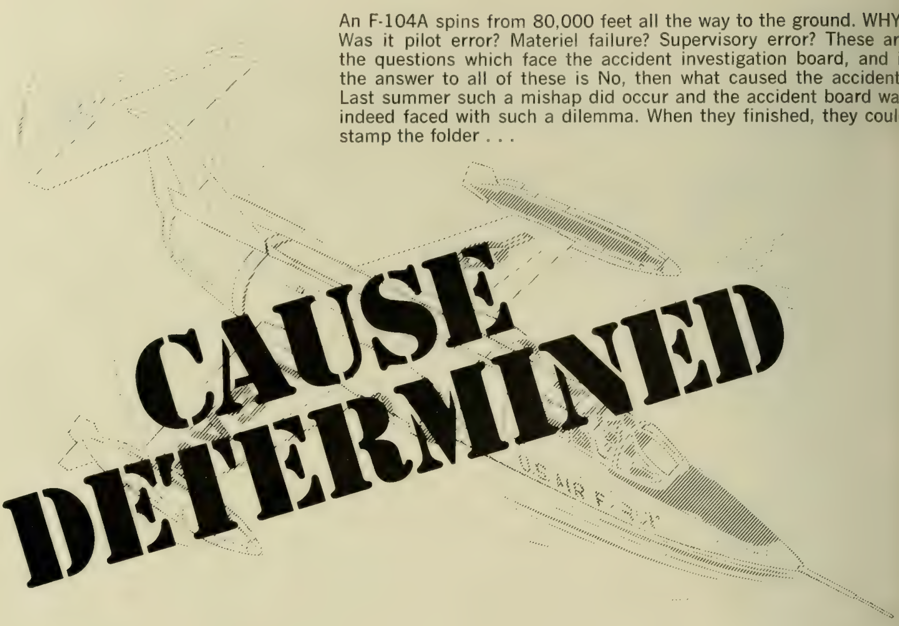
If your clearance limit is a VOR or ADF facility, maintain the assigned altitude or minimum safe, whichever is higher. If your altitude is above the penetration turn altitude but below initial penetration altitude, your problem is to position the aircraft on the published procedure flight path. Conforming to the published course and altitude combinations will assure you enough time to descend and accomplish pre-landing checks before arriving at the low station. How do you intercept the flight path?

SAC recommends a technique that seems to work well. This technique is to fly outbound on the penetration course at your altitude 15 seconds for each 1000 feet the aircraft is below the initial penetration altitude and then complete the penetration procedure. You might consider the adaptability of this technique to your aircraft and mission.



Next month, we'll consider techniques to use when you are below penetration turn altitude or using TACAN. ☆

An F-104A spins from 80,000 feet all the way to the ground. WHY? Was it pilot error? Materiel failure? Supervisory error? These are the questions which face the accident investigation board, and if the answer to all of these is No, then what caused the accident? Last summer such a mishap did occur and the accident board was indeed faced with such a dilemma. When they finished, they could stamp the folder . . .



CAUSE DETERMINED

A student of the Aerospace Research Pilot School at Edwards Air Force Base was performing a scheduled, properly planned, and properly executed zoom maneuver as a part of the prescribed curriculum. The maneuver was performed within the profile limitations as outlined in the applicable technical order. This zoom maneuver was the fifth zoom mission performed by this pilot and was to take him to an altitude of nearly 90,000 feet.

The entire mission up to the peak of the zoom was normal. The afterburner blew out at about 62,000 feet, the engine was shut down and the UHF radio was turned off at 75,000 feet. The maximum altitude attained was 83,000 feet MSL. Near the top, the pilot noted feeling one stick kick which he thought to be from the Automatic Pitch Control system of the F-104. He immediately applied full forward stick. The nose of the aircraft started downward normally; however, as the nose fell through, the aircraft also yawed to the left approximately 135 degrees. The motion stopped momentarily with the nose somewhere between level and 45 degrees nose down. The nose of the aircraft then yawed right as the nose rose to the horizon. This right yaw at a level pitch attitude developed into a flat spin which continued to the ground.

The pilot applied all the proper spin recovery techniques with no apparent affect on the spin or pitch attitude. Attempts to restart the engine, recover by using the drag chute, etc., all failed. The pilot successfully ejected at about 4000 feet above the ground.

At the Air Force Flight Test Center there were, fortunately, many facilities available to measure and analyze this flight. For instance, from the radar plot of the zoom, the flight conditions at the top of the zoom were calculated to be 83,000 feet of altitude, 220 knots true airspeed, 48 knots indicated airspeed, and a q of eight pounds per square foot. Now q, the dynamic pressure, is very important to this analysis where:

$q = \frac{1}{2} pv^2$

and p = the density of the air

v = the true velocity

q can be thought of as measured by the airspeed indicator; low indicated airspeed means low q.

The intricate technical details of this flight will not be discussed here, but let us defer to the ways in which the questions of what happened and why were determined. The combination of equipment and engineering talent, both available at the Flight Test Center, and the germ of an idea coming from the investigating board brought forth the answer. The board wondered what takes place at low q at high altitude, and, in particular, what are the forces on the airplane? Aerodynamic forces as a function of the dynamic pressure, q, are obviously far less influential than at normal flight conditions. If inertial forces are predominant in this flight regime then what are they? And what are their relative effects?

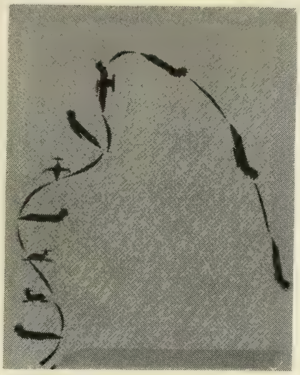
Analysis did reveal the inertial forces to be predominant; but because of the low velocity at the

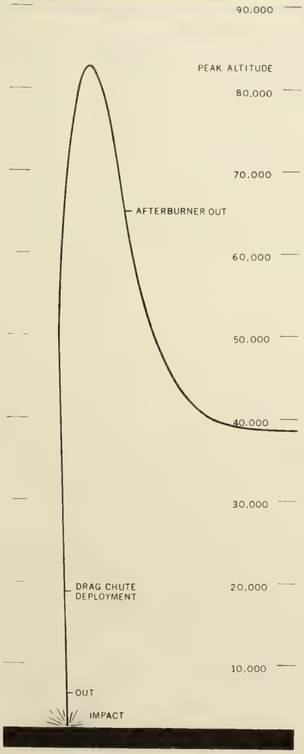
By Col James H. Polve, Director, Flight Test Engineering
Air Force Flight Test Center, Edwards AFB, Calif.

peak of the zoom, the effects of the inertial forces with regard to the ballistic trajectory could be considered minor compared with the inertial forces caused by the large rotating engine. Thus, the idea of the gyroscopic effects of the engine materialized.

As a result of the flight test program being conducted at Edwards on the NF-104, there was available an analog simulation of this airplane which was quickly adapted to the F-104A. The method of attack was to first reproduce the known flight path on the simulator to give motion in the vertical plane only. The flight path, as determined through the radar plot, was matched on the simulator based upon the known initial conditions such as Mach number, altitude, pull-up acceleration, pitch attitude, etc. This matching coupled with the characteristic performance and stability parameters of the F-104A gave representative simulation. The simulator responded in exactly the same manner as did the actual airplane and gave the same flight path up to the point where the airplane went into its uncontrollable maneuver.

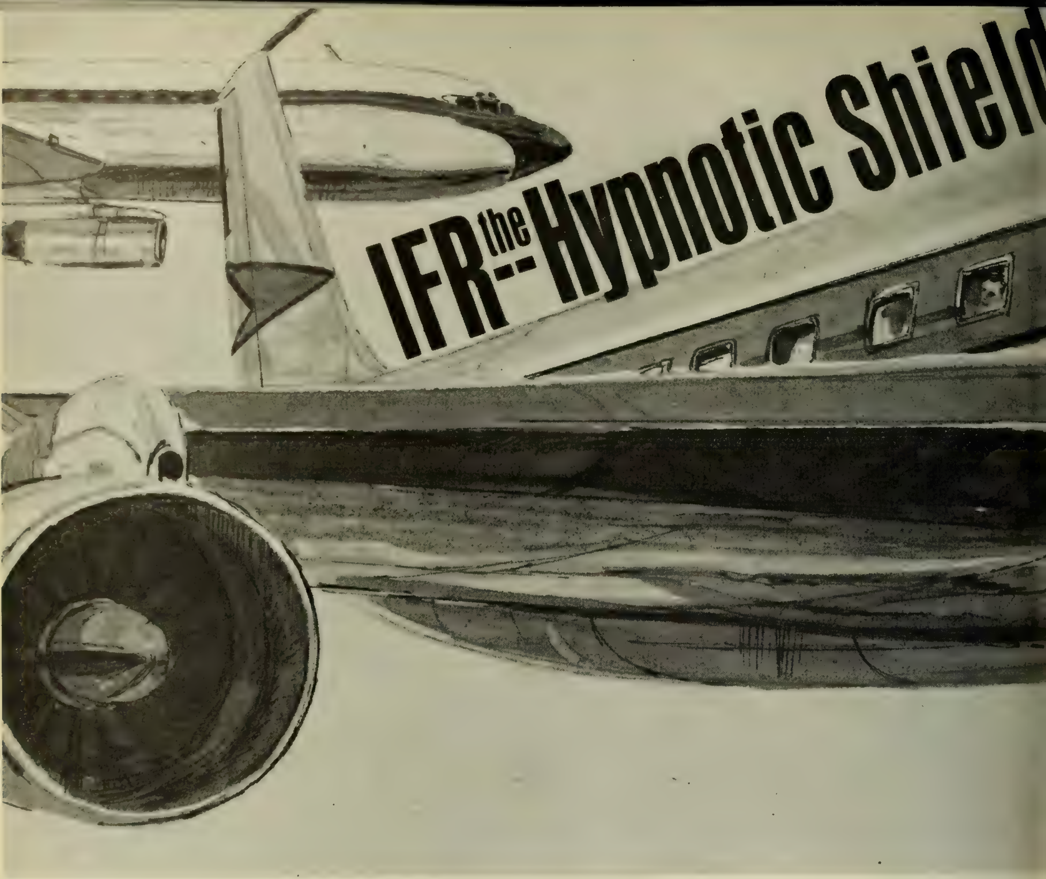
Another analog simulation to give rotational motion about all three axes as well as vertical and sideward motion was then programmed to the same conditions existing at this point in the flight path. The results of this study showed that it was possible to get the same uncontrollable maneuver experienced by the actual airplane under these conditions. The studies showed that at low airspeed, or low q, the engine RPM caused the airplane to behave initially just like any other gyroscope, because even at the relatively low RPM of 50 or 60 per cent, the engine was still turning over at 4000 rpm or more. As is well known, any movement of such a gyro causes precession 90 degrees to the direction of motion. For instance, in this case a negative pitch rate caused by a rapid push over or forward stick action caused the airplane to yaw left. This left yaw was induced from the gyroscopic action of the revolving engine. The yaw, in turn, created a rather fast left roll caused by dihedral effects. The inertial forces and the aerodynamic forces coupled in the form of a yaw-roll maneuver to place the aircraft at an excessively high angle of attack. Simultaneously, this disturbance triggered an inherently unstable mode in the F-104A to induce a divergent lateral-directional oscillation. The resulting spin may have been initially just one cycle of this oscillation, but with the aircraft oscillating directionally and at a high angle of attack longitudinally the spin was virtually inevitable.





A seeming paradox was uncovered in this analysis. The gyroscopic effects of the engine led to the initial oscillatory spin, and as the engine RPM decayed to a low value, essentially zero, this spin evolved into a flat spin. The normal F-104 oscillatory spin depended on high engine RPM and the consequent gyroscopic effects for its oscillating motion. This motion of the nose oscillating above and below the horizon created the favorable environment necessary for recovery using the prescribed techniques. No known recovery of an F-104 has ever been made from a flat spin. Thus, the inertial forces that caused the entry into the spin would have aided in recovery if they could have been preserved by maintaining high engine RPM.

The investigation showed that the factors contributing to the cause of this accident were none of the ordinary factors for which we normally look. The analog computer proved that this accident resulted from the airplane being flown in a hazardous flight regime, a regime of low dynamic pressure, where the inertial forces of the engine predominated over those forces in control of the pilot to cause an uncontrollable maneuver resulting in a flat spin from which recovery could not be affected. ☆



IFR--the--Hypnotic Shield

By Capt David E. Craig, Air Force Special Weapons Center
Kirtland Air Force Base, New Mexico

The New Jersey coastline slips rapidly underneath; you are fascinated by the hazy New York skyline and the massive fleet of fishing boats moving out to sea. The public address system crackles: "This is your Aircraft Commander speaking. Welcome aboard Flight . . . We are now passing 5000 feet, climbing to cruising altitude of 31,000. We are on an IFR clearance via airways to . . . The weather enroute is excellent with only a few scattered clouds forecast. If any members of the crew may be of assistance, please feel free to call upon us. Relax and enjoy your flight."

The steady voice of the Aircraft Commander reassures you, but you question yourself: Why an IFR clearance if the weather's so good? You are handed a cup of coffee and retire to your newspaper. Suddenly your tranquillity is broken—

A flash of light snaps your eyes to the cabin window in time to glimpse an airplane crossing your path close—*too close*! As you stare, in shock, at the window, a little man appears on the window sill and yells: "Your crew is hypnotized!" You grab for him to wring the truth from him, but in vain—he's gone!

You pinch yourself and it hurts. You're dead sure you saw the other airplane as big as life; but that little man's proclamation—incredible as he was!

Impossible? Improbable? No, crew hypnosis is possible and highly probable!

Want a quick lesson in hypnosis? According to Webster, to hypnotize is: ". . . to entrance or overcome by suggestion." Just talk a flight crew into filing a low altitude IFR clearance through VFR conditions and you're well on your way to becoming a master of the art. The clincher occurs just before takeoff: "ATC CLEARS . . ." The inherent danger in practicing this art is that, once cast, the trance is practically unbreakable so long as the IFR clearance remains in effect.

How does the trance affect the performance of the crew? Psychologically, a spherical shield surrounds the aircraft protecting it from *all* potential external dangers; therefore, attention is concentrated *inside* the cockpit rather than *outside.* Precise radio navigation and associated log keeping, so essential to actual IFR operation, occupy much of the crew's time—even in instances where familiar routes could be accurately flown via pilotage. In general, the crew tends to perform their duties in the exact same manner and extent that they would be expected to—if they were flying in actual IFR conditions!

This situation is not a case of misinterpretation or ignorance of regulations—merely a false feeling of security initiated by "ATC CLEARS" and reinforced by the thought that VFR traffic maintain their own separation and the knowledge that radar controllers are usually very helpful in giving "VFR traffic advisories."

A typical traffic advisory is: ". . . unidentified target at nine o'clock, five miles, southbound, slow moving, altitude unknown." Does such a statement remove the trance? No, this is merely another type of suggestion which, while it does cause attention to be shifted outside momentarily, causes the visual scan to be concentrated in the nine o'clock direction. If the target is not immediately sighted, the assumption follows that the target is above or below and presents no threat. But, could the controller have *meant* three o'clock direction? Competent as controllers are, it has happened!

Another shocking suggestion which has the appearance of being a genuine trance breaker is: ". . . make climb VFR from 7000 to 9000 feet—I have traffic southbound on V-16 at 8000 estimating . . ." This is the one which makes a small hole in the shield temporarily; the eyeballs cage outside on the twelve o'clock high position and will remain so until the target is sighted; or, until well past 8000 feet. Meanwhile, all other sectors are disregarded in favor of looking for an aircraft which presents no real threat in the first place; if such threat did exist, a radar vector off airways would probably have been issued.

What, then, are the real trance breakers? ". . . be extremely alert; I have numerous unidentified targets along your flight path." These are the magic, seldom spoken, words which can jar a crew back to reality. They forcibly remind the crew that they're on their own with respect to other (VFR) traffic. The other possibility is a crew-initiated cancellation of IFR clearance; however, this method is not generally as effective because of subconscious reliance on continued radar traffic advisories.

The purpose of this article is not to discourage operation on an IFR clearance at any time; however, it is intended to vividly show what can (and does) happen when we allow our subconscious to be deluded by such things as: "ATC clears . . . ," "traffic advisories will be issued," "other (VFR) traffic is responsible for maintaining their own clearance," etc. True, the most severe examples have been used to emphasize the results; radar controllers *usually* do keep aircraft well advised on other conflicting traffic, other (VFR) crews *usually* do look out, and IFR crews *usually* are not influenced to the degree depicted herein.

What can we, as pilots and crew members, do to enhance our safety (as well as that of others) when regulations or conditions require flight through VFR conditions while on an IFR clearance? Obviously, prevention of the hypnotic trance is preferable. Although not completely preventable, complacency can be avoided by self-initiated reminders, before flight, that an IFR clearance only "guarantees" clearance from other IFR traffic which, in low altitude VFR conditions, may be as few as one aircraft in twenty. To combat the inevitable partial trance, we must issue our own trance breaker immediately after takeoff: "BE EXTREMELY ALERT . . ."

In conclusion, when flying in VFR conditions, the added task of navigating in accordance with an IFR clearance does not alter the fact that we are still VFR and responsible for maintaining our own separation by looking out the windows. ☆

Controllers Cited

Three saves and the successful guiding of 20 aircraft to safe landings during an emergency earned the 1936 Communications Squadron at Lajes, Azores, high praise from Air Force Secretary Eugene Zuckert.

During the afternoon of Oct. 7, Lajes was experiencing a light drizzle with broken clouds when the RAPCON arrival controller received a call from a Navy jet. The pilot explained that his aircraft and three others from the USS Roosevelt were dangerously low on fuel and must land at Lajes. Adverse weather prevented them from returning to the carrier.

After making preparations for handling these aircraft, the center was alerted to receive 16 more diverted from the carrier.

The weather was fluctuating—one-quarter to one mile visibility under a 200-400 foot ceiling. All aircraft were requesting straight-in approaches with power cut to minimum to conserve fuel.

Because of the weather and position of tower on high ground, tower personnel could not see the runway. Aircraft could not fly holding patterns because of low fuel state. Radar frequencies were saturated from the start. Nevertheless, within minutes additional controllers reported and talk-downs began. The first 11 aircraft—all stating emergencies because of fuel shortage—were recovered in about 15 minutes. ☆

Office of Information, Hq AFCS

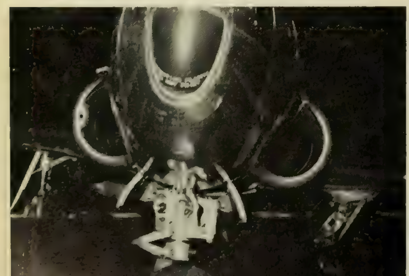
TAXI ACCIDENTS

No brakes . . . assistant crew chief failed to turn on the hydraulic switch.

There's an old axiom th
"There's no excuse for a ta
show that since 1958 the A
than 15 taxi collision accide
1964 was the worst year w
reduce this rate? Possibly,

- All personnel author
verify that starting units a
- Crewmembers woul
list procedures and questio
time limits that are unrealis

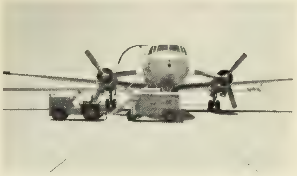
Pilot error. Taxied into open ditch in construction area. Hazards are harder to see at night.



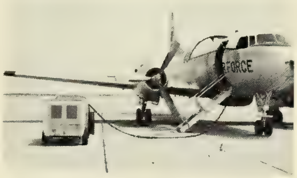
He made it between the poles, but see what a wire did to the tail. At strange fields, particularly, get a Follow-Me.

Pilot failed to assure
fellow who planted the tr

A T-29 after collision with a starting unit.



Approximate position of power cart and tug prior to accident.



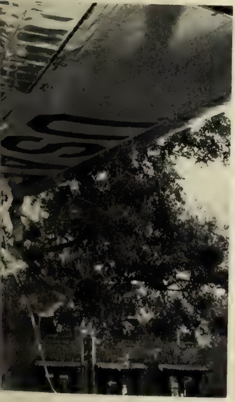
Starting unit correctly positioned.

nething like this:
.” Still, statistics
s averaged more
ts per year. And
an 20. Can’t we

t engines would
positioned.
proper check-
nger/cargo stop

- Wheel chocks were used during engine starts, even during through flight starts.
- Pilots and copilots would make pressure checks, and look outside while taxiing.
- All pilots would adhere to AFR 60-11, which requires wingwalkers within 25 feet and tugs within 10 feet of obstacles.
- More care were exercised when taxiing at strange airfields, particularly non-Air Force airfields.
- Operations personnel would brief departing transients on hazards.
- Hazards were NOTAMed.

And it's useless to blame the



No wingwalker as required by regs. While taxiing between rows of parked aircraft, pilot collided with parked refueling truck.

Civilian operator attempted to taxi Air Force transport without wingwalker.

THE TIME IS NOW

By Maj William R. Detrick, Aviation Physiologist, Asst for Medical Services, DTIG

H-hour is now! You, Captain Average A. Crewman, USAF, have just been forced to abandon your disabled aircraft. Although you were sure it couldn't happen to you, it just did. That fire warning light was for real this time and the bird was unusable for further transportation. You pulled the ejection trigger or dropped through the escape hatch. This is no dry run or training exercise. It is a very stark, startling fact—THE TIME IS NOW!

Will your escape be successful? Will you live to fly again? Or will you perish in a watery grave? Will you throw away your life because of carelessness or forgetfulness? Or will it be "lack of training" or perhaps just lousy equipment? Standby one on this channel and let's spend a few minutes coffee break time to think about this.

Since 1950, the Air Force has averaged 331 bailouts and ejections per year, 85 per cent of which have been successful. Hold one, though. Our definition of success means that you not only ejected safely but descended to the ground and were rescued or picked up alive. If you die during the parachute descent or survival phase, it's an unsuccessful ejection. The improvement of the ejection system and parachute has been the subject of previous articles in AEROSPACE SAFETY, therefore, what happens after the parachute descent will be our subject. Most of our survival fatalities *could have been prevented.*

Our definition of a *survival situation* includes *all* water situations and those on land where the individual is not picked up in one hour. By this definition, from 1958 through 1963 there were 697 persons who fell into the survival category. Almost a third of these are still missing, all but one over water. A majority of these were probably not survival cases, but the mere fact that they are missing means we cannot assume this. Of the individuals who were recovered, 10 per cent had suffered fatal injuries. As would be anticipated, most of the fatalities occurred following water landings. Land accidents, although involving few fatalities, did involve a large number of injuries. More than half of those who survived were injured.

Half of the persons involved in water landings were rescued in one hour or less, most within the first 20 minutes. If an individual can cope with the first few minutes following a water landing, the probability of survival and eventual rescue is greatly enhanced. During the six years only 41 individuals were not rescued within 24 hours. Rescue or recovery time of these individuals ranged from 24 to 72 hours for those rescued alive and to over five months for recovery of the fatally injured. Twelve of the 41 died, 10 suffered major injuries, and 19 minor or no injuries.

The information that an individual has been involved in an aircraft accident triggers a vast program of search and rescue activity. Rescue efforts are greatly aided if the downed airman can make his whereabouts known. During the six-year period, 506 methods of attracting attention were listed. Light signals in various forms (flares, fires, and flashlights) played a prominent part. The flare, particularly on water, was the single most useful signaling device available. Survival radios contributed very little to the overall locating function. This was due not only to faulty radios but to widespread lack of knowledge regarding their use.

Now that you have some of the big picture, let's take a look at some of the attention-getting survival situations over the past several years. Most of you have already read about the B-52 crewman who was apparently without serious injury after bailout into bitter winter weather. Even though he had been through several survival schools, he walked away from his survival equipment and perished of exposure. He had the equipment and had been trained in its use, but DIDN'T use it correctly and died. Another crewmember in the same accident did everything he had been trained to do and is a shining example for survival schools for years to come.

A jet fighter pilot was forced to eject over the north Atlantic last year. Even though he had not worn his exposure suit for this flight, he lived for over 14 hours in cold water, about three times longer than he was supposed to last. He died during the pick-up operation. Rescue crews are still wondering why he made no attempt to use one of the two mirrors or other signaling devices he was carrying with him. Another second guess, had he been wearing his poopy suit, he undoubtedly would have been in much better shape to help himself during the long ordeal and rescue attempt.

Another jet fighter pilot ejected into the relatively warm waters of the Gulf of Mexico, several months back, and survived for 40 hours before pick-up with only an under arm life preserver for company. He reports that he was forced to jettison his chute harness just after entering the water, thereby losing all of his survival goodies. Any one of the signaling devices in that kit would have worked, since rescue planes flew over and ships came near many times before his actual rescue. According to his account, that pocket flare kit lying at home on his dresser really would have come in handy. His physical stamina and "will to live" helped him survive the long ordeal before an almost miraculous pick-up.

The Air Force is well aware of equipment problems. Some of the things being purchased to help in this area are:

- The URT-21 personal locator beacon, an automatic beacon that will be packed in your parachute pack to broadcast an emergency signal on Guard channel upon parachute deployment.
- The SDU-5/E marker distress light, a pocket sized strobe beacon which will be strapped to your harness for emergency signal, particularly at night.
- The pocket flare gun, a pen gun type flare easily carried in one of your flight suit pockets.
- The CWU-10/P and CWU-12/P anti-exposure suits; both models are attempts to give you more comfortable equipment and better protection.
- The URC-10 survival radio, a transistorized, waterproof version of the transceiver type.
- Improved MK-13 Model O day-night flares for carrying in the survival kit.

All these devices have been a long time in coming and will appear, in part, through the efforts of an extremely important body—the USAF Personal Equipment Advisory Group (PEAG). The PEAG is made up of representatives from each operational command, the research and development agencies, logistic people—including each depot responsible for personal equipment items — and various staff agencies in Headquarters USAF with responsibilities in this area. In addition, friends from the Army, Navy, NASA, and Canada attend. Nearly everyone has a representative in his major command headquarters who is a member of this group. Suggestions and requests for changes or new equipment should be funneled through this individual.

Now, it only seems reasonable to expect you, Captain Average Crewmember, to do something to help yourself. As the Boy Scouts tell us, "BE PREPARED." First of all, you should know your equipment and how to use it. "But," you say, "I've already been through the required survival lectures and have seen all the latest films." That ain't enough, friend. You must *know* what's in that kit. Each item should be examined, sniffed, handled, explored and used until you can do it with your eyes shut. (Do you know by feel which end of the flare is the night end?) Second, you must have the equipment along and in good shape to protect you, should you need it. The pen gun flare on his dresser didn't help that pilot in the water. I know the exposure suit is uncomfortable but so is the parachute and the oxygen mask and helmet—all equally important life saving devices.

In the Hell's Canyon accident several years ago, passengers and crew of a transport that left a sunny southern base were forced to bail out into the frigid snow of mountainous Utah. Half of them died needlessly because they were in summer clothing without proper survival equipment. You don't need to wait on a regulation or directive to tell you what to wear or carry while flying. Common sense should do it.

Let me suggest some items that might come in handy in an emergency, in addition to cold weather and water survival (flotation) gear. A signal mirror can be easily carried in your flight suit pocket and is an excellent signaling device, IF you know how to use it. A pack or two of waterproof matches, very easily carried. A reliable but small flashlight makes a good signaling device. How about a police whistle? Better than yelling! There are many other gadgets that might be in the "nice to have" category, but don't get carried away! Remember, you want to stay alive and to help others rescue you, not set up housekeeping for a month. It's not a matter of keeping comfortable but staying alive.

Seems to me I've read several times on these pages the remark that we are professionals and should act like professionals. I believe this cliche applies here. I don't mean we should stop griping about unsatisfactory equipment; intelligent gripes give us an indication of what is wrong and how to correct faults. I do mean we should know our equipment and how to use it. The best equipment is no better than the individual operating it or using it. And last of all, we should exercise enough self-discipline to make sure we are carrying the proper equipment for the terrain over which we are flying. Remember, should you have to eject, survival becomes very real and it *is* happening to *you*.

The TIME IS NOW! ☆

DON'T PUT OFF UNTIL TOMORROW

By Lt Col A. C. Eggleston, Directorate of Aerospace Safety

Safety surveys and missile incident and accident reports reveal an excessive number of delayed and repeat discrepancies which have caused or could cause catastrophic failure. An extensive review of similar weapon systems and units indicates there is a wide variance in the number of delayed discrepancies per complex and organization. Ground rules also differ in each organization as to the method of reporting delayed discrepancies; e.g., one organization identified in excess of 15 components requiring corrosion control on separate AFTO Form 209 entries.

Now let's get down to the source and causes for the excessive number of delayed discrepancies. Missiles can be launched on a tactical mission with one or two redundant systems inoperative. Knowing this and the requirements by higher headquarters for maximum alert posture, personnel at squadron level are prone to live with delayed discrepancies rather than explain down-time required for unscheduled maintenance.

Planning and scheduling must be accomplished well in advance of all multiple maintenance tasks to insure that specialists are not attempting to perform at the same time tasks that require different configurations of systems in work. Only qualified personnel who understand the relationship of these tasks should be assigned in plans and scheduling. Too often during field visits, lack of good, sound, logical planning has been observed.

What happens when a missile specialist drives 35-75 miles to accomplish a work order and finds he has forgotten his tools or replacement part or has the wrong tech data? He reports to the complex chief that he is unable to accomplish his work order; it is then reported to job control for rescheduling. Any of us who are familiar with this situation can visualize the shouting and earth shaking which evolves from this forgetful act. These time delays and errors will be eliminated only through careful planning, coordination and last minute prebriefing by the specialist's supervisor.

Another time consuming delay results from inadequate troubleshooting. A specialist determines that a replacement part is required. After hours, possibly days, this item is delivered to the supply point and scheduled for installation. Now another specialist discovers that he is able to make an adjustment to correct the reported malfunction. According to their job training standards, both specialists were equally qualified. Our area of prime concern is: Will the supervisor be informed of this occurrence and will he do anything to improve trouble shooting techniques and reduce needless expenditure of valuable manhours? The cited examples are typical throughout our missile units and, to a degree, affect reliability and contribute to accidents.

Repeat discrepancies, like delayed discrepancies, are of prime importance and must be corrected in the interest of accident prevention. Too often the area defined as primary cause of an accident reveals a history of repeat malfunctions within a relatively short period of time. On any critical system, only our most highly skilled personnel should be used. Then if there is any doubt of complete corrective action, don't hesitate to ask for depot assistance through T. O. 00-25-107 channels.

Supervisory personnel should review all repeat and extended delayed discrepancies as though they were accident investigation board members reviewing these writeups to determine the primary cause of an accident. If, during this review, you find potential killers, be sure that positive corrective action is taken to eliminate any element of doubt. ☆

Aeromed Squadron Accident Free

If all the accident free flying hours compiled by the 12th Aeromedical Transport Squadron were put together in sustained flying for one plane, that plane would be in the air continuously for eleven and one-half years.

Early this year, the squadron, based at McGuire Air Force Base, N.J., passed the 100,000 accident-free flying hour mark. In reaching this goal, the squadron flew 24 million miles, or the equivalent of nearly 1000 times around the earth.

With four C-131 Samaritans assigned, the McGuire squadron, part of the 1405th Aeromedical Transport Wing, is responsible for the transportation of Department of Defense patients to specialized medical facilities throughout the Eastern part of the United States. Other detachments of the 12th AMTS are located at Andrews AFB, Md., and Maxwell AFB, Ala.

Under the direction of Headquarters MATS, the 1405th, with three other squadrons like the 12th, operates the domestic aeromedical transport system servicing the entire nation.,

An aeromedical aircrew is a unique team trained to operate an airborne hospital ward. The aircraft commander is responsible for the safe and efficient operation of the aircraft and crew. He is assisted by a copilot and flight engineer and a medical crew consisting of a flight nurse and two aeromedical technicians. The latter three are responsible for the health and welfare of the patients being carried. This combined effort of flight crew and medical crew insure the operational success and the medical integrity of the mission.

"In a small organization such as ours, the accumulation of 100,000 accident-free flying hours must necessarily occur over a long period of time; and credit must be given hundreds of people now departed, who contributed to this noteworthy achievement," said Lt Col Harold H. Imhoff as he congratulated the 12th's pilots and flight mechanics, nurses and medical technicians, maintenance and support personnel, past and present.

Maj Charles C. Yoos, who, with the exception of a tour in Korea and one in Alaska, has been with the squadron since 1949, recalls when he first joined the squadron as a second lieutenant. "We were located at Westover Air Force Base, Mass., and were known as the 1732d Air Transport Squadron. We flew the C-47 Gooney Birds until 1954 when we gained the C-131's, which we presently have in operation.

"I think the thing that has been most impressive to me has been the advancement of the aeromedical transport system to the well controlled, professional approach which we have today.

"It's been very gratifying throughout the years, and continues to be today, to be able to transport patients and have the feeling that in some way you have contributed to their welfare, or have helped save a life."

There are interesting sidelights to the background of the flight crew that actually flew the one hundred thousandth hour. The aircraft commander of the flight, Capt Donald H. Hutchinson, is the first Viet Nam returnee in the squadron to be upgraded to aircraft commander. First Lt. John W. Clar, the flight's copilot, is the youngest member of the squadron. Major Yoos, who has served more years in the squadron than anyone else, was the flight examiner. ☆

Office of Information
1405 Aeromedical Transport Wing
Scott AFB, Ill.

Members of the crew that flew the 12th Aeromedical Transport Squadron's 100,000th accident-free flying hour pose in front of their C-131 "Samaritan" at McGuire AFB, N.J. They are from left, standing, SSgt John T. Lowe, medical technician; SMSgt Joel L. Blanton, chief of maintenance; 1/Lt John W. Clark, copilot; Capt Avis R. Hildebrand, flight nurse; A1C Robert W. Stevens, flight engineer; Capt Donald H. Hutchinson, aircraft commander; Maj Charles C. Yoos, flight examiner; and A2C Leroy L. Branch, medical technician. Kneeling are A2C Gary R. Fenn, left, and SSgt Lyman H. Look, both aircraft mechanics.

HEADIN' HOME

By a USC-FSO Student

The cloudless sky indicated that this was going to be another hot day, just like yesterday. We were going off alert in about half an hour. After briefing and changeover, we would have nothing to do except pack our bags, put the forecast wind on our flight plan, and wait for 0600 tomorrow for our flight home. This had been a long alert tour. Our replacement crew was two days late arriving, so we were really keyed up to be on our way.

Briefing seemed like it would never end but one thing caught our attention: The briefing officer said we would taxi our own aircraft off the line and our replacement crew would put theirs on. Since this was not the normal procedure, we began to pay attention to the briefing.

After turning over the classified material to the other crew, we climbed aboard our bird, started the engines and taxied over to the downloading area.

As we were shutting down the engines, the Reflex Commander climbed aboard and asked if we thought we could make a 1000 hours takeoff. It would take at least that long for the ground crew to download the bird, which included offloading at least 4000 pounds of fuel. Furthermore we weren't packed and didn't have the latest winds on our flight plan. I told him I just couldn't see how we could make it. He told us to go pack our bags while he found a crew to preflight our aircraft and a crew to complete our flight plan and file it for us. That way we should be able to make it.

Excited that we were going home a day early, we headed for the alert facilities. We were back at the bird in 45 minutes but things there weren't going too well. The ground crew hadn't downloaded the bomb bay yet and then it would take another 30 minutes to remove the fuel. Our hopes of going home vanished like water down a drain.

As we stood there talking about our hard luck, the operations officer drove up and wanted to know how we were doing and whether we were going to make our takeoff time. When I told him that it was impossible, he told us to keep doing what we could while he called Hqs to see if they would adjust the takeoff to 1200. "Do you think you can make that time good?"

We all agreed that we could if it didn't take the ground crew too long to download the bird.

About 15 minutes later the operations officer returned and told us that Hqs had extended our takeoff time to 1200 but if we weren't off the ground by then we would be canceled for the day. Our hopes went back up as this gave us over two hours to make it.

The copilot had the operations officer drive him to base weather so he could get the forecast temperature for 1200 in order to compute new takeoff data. I stayed at the aircraft so I could hustle up the downloading.

The next thing I knew, the team chief walked over and told me the hoist was broken and it would take about an hour and a half to get it fixed and finish with the downloading. That would leave about 30 minutes before takeoff, not enough time to download the fuel and make the takeoff time good.

When the copilot arrived back at the aircraft, he said that we would have to download 6000 pounds of fuel instead of the planned 4000 pounds. This presented another problem: not only would it take

longer to download us but we would have 2000 pounds less fuel at destination. Our flight plan called for us to arrive there with 20,000 pounds and now we would have only 18,000 pounds—the minimum required by regulations. If our flight plan wasn't right on the money we would have to divert to another base.

At 1135 the ground crew finished downloading the bomb bay, but we still had the 6000 pounds of fuel to get rid of. We talked it over and decided to try to make our takeoff time good by burning the 6000 pounds when we reached the end of the runway, plus what would be left of the 2700 pounds that was computed to be used for engine start and taxi.

At the end of the runway we had used only 1700 pounds of fuel so we were now 7000 pounds over planned with three minutes to go before takeoff. A decision had to be made. Should we go over weight or cancel and taxi back in to the ramp? I didn't want to make the decision by myself. A quick conference and we agreed to take the chance and GO.

Now the stage was set for an accident: too much fuel, erroneous takeoff data due to weight, inadequate flight planning and gethomeitis.

At brake release we were 6500 pounds over the weight that was used to compute our takeoff distance and speeds. If all engines operated normally, we should be able to make it, even if we were 6500 pounds heavy. Our speeds would be off the computed, but we would subtract a couple of knots for S-1 speed and add a couple for liftoff and that should be close. Beside we all wanted to get home today.

The navigator made the countdown for brake release, "5-4-3-2-1, GO." The heavy bird started rolling, with black smoke pouring from its six engines. Engines checked good, all gages were GO.

The copilot called the 70 knot check; I checked the engines again and told the navigator to add another second to his timing for the S-1 check. When the navigator called S-1 time, I made a quick check of the engines and airspeed. Everything was good except that the airspeed was about two knots low; but we had expected that so we were going. All that was left to do now was to get the bird into the air before we ran out of runway.

Everything looked good until we were indicating between 135 and 140 knots. Then it seemed that the bird quit accelerating. We were using up the remaining runway fast now. I began to wonder, "Are we going to make it? Are we going to get home tonight?" In fact, I began to wonder if we would ever get home and, if so, just how. Would it be several months later, with parts of us missing? Or would it be in the well known "pine box." So many thoughts were going through my mind that I didn't notice that we had started picking up speed again. All I could see was the end of the runway coming fast. When the aircraft did get flying speed, we had used all of the runway and some of the overrun—a total distance of 11,500 feet against computed distance of 9100 feet.

No, there was no accident this time, just a severe case of the shakes and a promise to myself that I would never again let the desire to get home overrule common sense and good judgment. ☆

FUN.. Can Be Hazardous!

Sports are for fun. When you indulge in sports and recreation this is your objective. It's your own spare time, and whether you will participate in a sports activity is, first of all, dependent upon your analysis of the question, "Will I have fun?"

Whether or not you will participate is dependent, to lesser extent, upon another consideration, "Can I afford it?" Skiing may be attractive, but the cost in transportation and equipment may rule out this sport.

Other considerations might be, "How strenuous is it?" "Will my friends be participating?" "What else can I do?"

Highly unlikely will be the consideration "How dangerous is it?"

After all, accidents happen to other guys. Naturally, if you figured you would be injured you wouldn't participate. You aren't completely crazy—you aren't going bull riding or entering the Indianapolis 500. You are only going skiing. But Mister, think of those three guys in your squadron who are hobbling around in casts; they didn't figure on breaking legs on the ski slopes.

Okay, it's your spare time and you'll spend it as you choose. Agreed. No one wants to curb your fun and we know you are going to ski, or whatever it is you've decided on, despite broken legs or broken necks. All we want is a few minutes of your time—not to cut into your fun, but to enhance it with a few tips on sports hazards.

We didn't select skiing at random. More accidents occur on ski slopes than in any other single area. But you are stationed in Florida and the only skiing you do is on water. Very well. Your probability of having an accident is cut nearly two-thirds. However, if you are a water skier, you probably do some swimming. Now, your chance of injury is virtually eliminated, but this is the greatest single cause of death among all sports activities. Two years ago, 30 airmen drowned, but none were killed on the ski slopes. But you say all you are going to do is ride around in the boat? You've only bettered your chances by about half. The year that 30 fatalities occurred from swimming, sixteen airmen lost their lives in boating accidents.

Golf is comparatively safe from accidents, but not everyone cares for the monotony of pull-cart hiking broken intermittently by moments of frustrating exercise.

Knowing that people are going to play around (fact, not assumption), our only aim in this article is to offer a few suggestions that may help *you* enjoy yourself by avoiding injury.

Here's where your hazards lie:

Most accidents occur in off-duty, unsupervised team sports. One-third more accidents stem from team sports than individual off-duty sports activities. Off-duty sports accidents exceed on-duty sports accidents on the order of more than 15 to 1.

Repetitive patterns have developed. Unsupervised off-duty water sports activities such as swimming, boating, water skiing, diving and fishing are deadly. In 1964, for example, water sports accounted for 55 of the total 114 sports-recreation fatalities.

In off-duty team sports activities softball and baseball are the perennial leading accident makers, followed closely by touch and tackle football, and basketball. This big three combination accounts for about half of all sports accidents. In individual activities, handling firearms while hunting or in target and skeet shooting takes a consistent toll in dead and injured.

If you have a non-fatal sports activity accident — and you are average—you can expect to be laid up for 10 days. (Incidentally, this costs the Air Force an average of 30 bucks a day.) Total per annum cost exceeds four million dollars! Sports and recreation accidents are second only to private vehicle operation in causing injury and death.

Painful as it may be, the knowledge that sports-recreation injuries cost the Air Force $12,000 per day is not nearly as impressive to you as your broken leg would be. So let's go further with suggestions that may help you from breaking it.

- Limit sports activities to your physical capabilities. Everybody can't be a rodeo rider.
- Proper pre-game warm-up is mandatory. To plunge right in may be more impressive, but the shock could kill you.
- Don't neglect your physical condition. Get your flight surgeon's advice.
- Don't play when you are ill. Relaxation is a better cold cure than recreation.
- If injured, see the flight surgeon before continuing play. It's better to be able to limp a little than to lie in traction.
- When tired, rest. Weariness is a warning—heed it!
- Examine the playing area for holes, wires, loose rocks and other hazards before the game. Be sure your equipment is in good condition and that you use the proper equipment. A golf cap is no substitute for a football helmet.
- Don't roughhouse or engage in horseplay. Being sorry never makes a broken arm mend faster.
- Establish safe ground rules to apply when hazards cannot be eliminated. Examples: a fly ball into the bleachers is out of play; throwing a bat is an automatic out; no one on the rink without skates, and all bowlers must wear bowling shoes.

"Hazardous Sports" deserve special mention. This category is set aside for those sports that have a high hazard history. Included are tobogganing, water skiing, mountain climbing, stock car racing and diving. Before you succumb to an enthusiastic buddy's sales pitch and step out the door of a Stinson at 3000 feet, check with your base safety office. At best, parachuting is a hazardous sport that requires superior equipment, training and procedures to insure safety.

Drag strips, dirt track and stock car racing are gaining in popularity. You may be another Dan Gurney, but how about your competitors? Have they had to pass driver certification procedures? Do the cars have to meet specified standards? Are safety regulations enforced and is the track equipped with adequate guard rails? Is the activity carefully supervised? Again, check with your local safety office.

Water skiing takes a high toll. The average man days lost per accident is almost double the overall average for sports accidents. Believe it or not, there are accidents on record in which the skiers involved didn't know how to swim.

Mountain climbing requires skill, know-how and specialized equipment. If all you want to do is go up, stick to the rolling foothills. It's easier and safer!

Now go out and play. Have fun —just don't die doing it. ☆

Missilanea

T. O. CURRENCY—During removal from storage, two AGM-12 wings were found to be damaged. Investigation revealed the damage probably occurred during packaging. The unit stated that no established packaging procedures exist in available technical orders.

Quality Control Sections take note: Packaging procedures were included in T.O. 21M-AGM12-101, dated 14 August 1963, which had been published over a year prior to the incident.

Are your files up to date?

Captain R. A. Boese
Directorate of Aerospace Safety

LET'S REPLACE "MURPHY'S LAW"—Throughout the life cycle of a weapon system, tech data are continuously developed, evaluated, supplemented, revised and up-dated to increase their effectiveness. Cases do exist where tech data, general in nature, leave implementation details to the user. Perhaps in the minds of the writer and the approving authorities, the steps were clear and seemed so basic that anyone could follow them. Perhaps, also, they overlooked a facet of the operation where "Murphy's Law" could be employed. (Unfortunately, Murphy's Bonehead Law is so well known that definition is not required.)

Supervisory, quality control, and skilled technical personnel must be relied upon to be the first to locate any possible area in which the "Bonehead Law" can be exercised and to insure that corrective supplementary procedures are available. Each member of a "two-man" team bears the responsibility to be alert to the fact that his buddy may have a tendency toward the "Murphy" concept.

A recent mishap illustrates the point. Tech data require checking a specific fuse and relay for operational condition for a particular security system fault. Apparently, it was assumed that power would be turned off before the fuse was removed, or if a condition existed precluding power shutdown, a standard insulated fuse puller would be employed. A dedicated student of "Murphy's Law" (together with a sympathetic buddy) was equipped with the "all-purpose" screw driver and proceeded to pry out the fuse in question. The result was inevitable. A fine metal bridge connecting the missile ground to a substantial positive electrical potential, initiated the unexpected—the firing of installed ordnance! The subsequent damage was serious and costly—it could have been catastrophic!

The results of the incident are under study and fixes will be developed to prevent the recurrence of this, as well as any other, malpractice that can be envisioned by careful study and analysis of the mishap. Tech data and weapon systems continue to prove that they are not infallible and avid proponents of "Murphy's Law" continue to locate the loop holes.

Why can't we start a new law? Like a "Kelly's" or "Casey's" Law, where technicians, supervisors, and other alert personnel out-do the proponents of Murphy's Law by getting the defense mechanism in print as tech data or operating instructions before "Murphy's friends" can discover their opportunity. It would be a great day if this new law became as widely known and followed as "Murphy's!" You know, gentlemen, no one gets paid extra for exercising Murphy's Law—far from it! But, if the new law were exercised in its initial phase on an AF Form 1000, called "Suggestion," someone could receive extra dollars in addition to the gratifying knowledge that he has provided a real benefit to his unit, and to the entire United States Air Force!

Lt Col Randall S. Kane
Directorate of Aerospace Safety

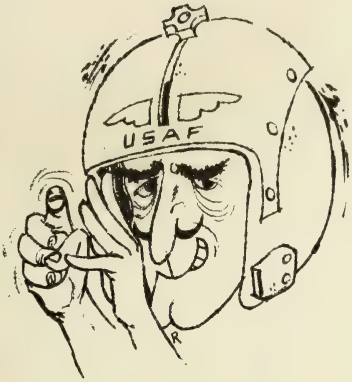
OUCH! MY PROBE IS BENT!—The OIC of Job Control made the decision to have a B-52G, with two mated AGM-28's, moved into a nose dock to keep the missiles out of inclement weather. As the aircraft started into the dock, the tail walker moved forward to the right front side of the tug to assure clearance between the tug and the dock's concrete wall. The left and right wing walkers were located forward of the wingtips to observe clearance between wingtips and dock doors and the NCOIC was located near the left front side of the tug to observe tow team members and general aircraft clearance.

The observer on the right side of the tug saw the pitot probe of the number two missile approaching dangerously close to the concrete walk, became excited, took the whistle from his mouth and yelled for the NCOIC to stop aircraft movement instead of blowing the whistle for an emergency stop. The NCOIC gave the driver the command to stop; however, the delay in giving the command permitted the pitot probe of the number two missile to strike the concrete wall. The probe and probe adapter were damaged.

Strictly a case of personnel error. The dock design would not permit a B-52 mated with two Hound Dogs to be towed far enough inside to permit closing the doors. In addition, the towing team did not utilize the signals established for the operation.

Major E. D. Jenkins
Directorate of Aerospace Safety

DOUBLE YOUR PROFICIENCY FLYING TIME....



By Col Robert D. Curtis
3615 Pilot Training Wing
Craig Air Force Base, Ala

If you're a CRT type pilot, I've got something for you. If not, this may be worth a few moments of your time anyway; I promise to be brief.

Over the past several years the Air Force CRT program has undergone several revisions which have reduced proficiency flying time. I'm one of those guys who like to fly, and my desire to fly has been strong enough through the years to prompt me to occupy a seat in an aircraft as often and as long as current policy has permitted. Each time the screw of further restriction turned, I squirmed. When the "big picture" pressures forced a limitation to 100 hours a year, I became concerned. When we were "permitted" to log copilot time in two-place training aircraft, it usually became very inconvenient for me to find another qualified pilot to go along. But finally, when policy required two rated pilots to occupy the driver seats and both were required to log pilot or copilot time, I was trapped for sure. How could I maintain a high level of pilot proficiency on a diet of 50 hours first pilot time per year? At first it seemed unlikely; certainly it was necessary to spend these few hours cautiously, doling them out through the months and making each flight as efficient in training value as was reasonably possible. Then my crafty mind produced the solution I'm passing on to you now.

Most CRT time is logged on out-and-back cross-country flights. Like any good guy, I split the front and back seat time with my fellow CRT'er. But, and here's the gimmick, when I occupied the rear seat, I flew hooded instrument time. As soon as the wheels went up, my cheery voice was heard through the intercom, "OK, I've got it." Later, often much later, when the GCA operator notified us that we were passing GCA minimums or the altimeter provided the same message on an ILS or VOR low approach, "OK, you've got it." The other guy, unaware that he'd been victimized and probably unwittingly thinking he'd been doing the piloting, courteously swapped seats and sat quietly while I flew the next leg from the front seat. Net result: just about 100 hours of proficiency flying time for each year's worth of CRT time. Ingenious?

Let's look more closely at the by-products of all that "bag" time. Flying proficiency carries along in good solid shape with 40 or 50 hours of hood time per year and, as an incidental bonus, instrument checks are a breeze. Ah, but you'll say, "Straight and level cross-country flying doesn't provide much useful practice." I'm ready for you; it can. It's going to be work, but here's how you do it. First, consider perfection as your goal. Work toward freezing the altimeter *exactly* on your assigned altitude. Lock onto and hold, to the degree, the correct heading. In other words, exercise hard and continuously the technique of rapid instrument cross check. Second, deliberately make it tough for yourself. Take over the radio calls. Do any fumbling with computer or inflight publications that is necessary. Dig out and study the let-down plates. Meanwhile, continue trying to control the aircraft precisely. Third, stick it out. If the flight is two hours and thirty minutes, spend two plus 25 under the hood driving. And fourth, take the trouble to convince those Air Traffic Control and RAPCON guys that you should be allowed a low approach.

What are you going to get out of all this? You'll maintain a high level of proficiency; you may even improve. You'll increase your ability to fly accurately when your attention is split by the outside demands of traffic control and flight planning. You'll develop endurance so that a long flight will not leave you exhausted at the time when the final approach requires your very best accuracy. Finally, knowing human nature, the other guy is likely not to be as conscientious (or as sneaky) as you; you'll double your proficiency flying time.

Come to think of it, 40 or 50 hours of hood time each year would probably make you a better pilot whether you're restricted to CRT flying or not! ☆

Aerobits

PE SHOPS, ATTENTION! — Here's what the message from a southern base had to say:

During normal repack and inspection of personnel parachutes, seven aneroids on the auto-release type F-1B were discovered leaking. This would have degraded the capability of the release to function at the preset altitude. Inspection of all parachutes on base disclosed 22 more malfunctioning aneroids. Recommend other units inspect for this discrepancy.

To which we add, AMEN.

A LITTLE DAB CAN UNDO YA . . . . Wasn't too long ago that a little dab of paint caused a tail hook to bounce allowing a fighter to miss a barrier cable. Now a dab of paint appears to be the culprit in a hard chopper landing. Seems the pilots were making a normal approach until about ten feet off, the pitch stick was being raised to increase collective when, after about one inch of travel, it jammed. Deceleration forces were sufficient to cause the rotor blades to flex and strike the tail rotor drive shaft. After considerable investigation, most probable cause was attributed to a dab of paint —this was the first time the chopper had been flown after a complete repaint job. It was thought that a thin paint residue that apparently had collected on the collective pitch control during repainting had worked down to concentrate on the phenolic blocks of the friction lock. This in turn apparently caused a momentary snubbing action, restricting movement of the collective pitch control stick.

T-39 FUEL VARIATIONS. Two transient T-39's were presumed to have been serviced with full fuel loads. However, during pilot ground checks both aircraft fuselage tanks indicated 500 pounds short. They were topped off with 96 gallons of fuel. Investigation disclosed that each aircraft had been refueled by the same servicing unit and that the fueling unit was operating normally. It was considered most probable that the fuel was delivered at a pressure high enough to create a back pressure in the fuel manifold, causing a stoppage of flow and indicating closure of the fuel level control valves. This probably occurred when all but the one tank had closed normally. The command concerned has directed that fuel quantity gages be checked to verify the amount of fuel prior to signing off Block E, Part II, AFTO Form 781. A power on check of fuel quantity gages to insure full fuel servicing is also recommended before flight. A check with North American discloses a fuel imbalance that can be experienced in this bird, provided all conditions are as follows: Fuel tanks in both wings are not full, the aircraft is not level, the cross feed valve is open and an O-ring in the cross feed manifold is unseated. Fuel can drain from the high tank to the low tank at a fairly slow rate and if the aircraft is left long enough (overnight) fuel weight will be heavy on one side. Reading of the fuel gages will disclose this condition.

WHAT'S SFA? "Air Force Jet 35212 departing FL 200 and Podunk VOR at 05."

"Roger, 35212, call penetration turn, expect GCA this frequency."

"Air Force Jet 35212, Podunk GCA, turn further right to 310, you are 11 miles on final approach, etc."

The transmissions you just read are typical of those received at many ZI and most overseas bases today. What's so significant? SFA—that's what! What's SFA? – Single Frequency Approach – that's what!

The Single Frequency Approach system as discussed in paragraph IV-B of FLIP Planning Section II, Flight Planning Document, has been implemented at many ZI bases and nearly all overseas bases. In your review of the Flight Planning Document information, you will note that this service enables single-piloted jet aircraft to remain on the same air traffic control frequency from beginning of penetration through landing touchdown. SFA enhances flight safety by minimizing cockpit distractions which could induce spatial disorientation. When the SFA note is shown in the enroute supplement communication data on a given airfield, no frequency change is normally required during arrivals, except when pilots are conducting "enroute penetration." There will be one frequency change when control is transferred from the Air Route Traffic Control Center to the terminal air traffic control facility.

TEN FEET LOW. The scar on the hillside was ten feet below the crest. Investigators looked at it, examined the pieces left after impact, reviewed events that led up to the scar and finally concluded that they could not determine the cause of this accident.

But they recommended that all pilots be briefed on it.

Termination of this pilot's career was marked with a brilliant flash made by 12,000 pounds of exploding JP-4. And, until a late change, he wasn't even on the mission. The three pilots in the flight had all been scheduled on separate missions; but weather, shortage of in-commission aircraft and other problems had thrown them together that morning. In fact, No 3 was added to the mission after Lead and the No 2 man had left for their aircraft. However, he caught up with them and received mission and weather briefing from Lead.

But this is a little ahead of the story. A slight slip somewhere along the line resulted in a nine being changed to a six in the mission symbol. For this reason the wing commander, when he approved the mission, approved a different mission—one for which weather was better.

Takeoff and climbout were routine. No 3 had a 10-degree discrepancy on his heading indicator, but fast slaving took care of this and subsequent heading checks were O.K.

The mission was high-low-high and ground radar had the flight under surveillance during the high portion. Radar plot showed the flight six miles off when Lead reported turning over a fix. He was navigating by airborne radar as his only navaid. Shortly after the turn Lead called pulling power back and a descent to low level was started. Lead transmitted the local area altimeter. Radar plots showed the flight to be approximately 16 miles from the desired letdown point at this time. Ground radar contact was lost during the descent. After letdown to the initial low altitude the flight leader flew an additional minute, then made a turn and let down to a lower altitude. This altitude was reportedly held for six minutes and another turn made. During flight on this leg Lead and No 2 both caught occasional glimpses of the ground through the clouds.

Letdown was continued for the next leg. At this time period of the mission, Lead did not recognize the return on his radar scope and decided to abandon the low level portion of the mission. He called pushing up the power and starting to climb. Immediately after this call No 2 reported seeing a flash which came from the No 3 position. He described the flash as a bright, narrow horizontal streak which appeared in his peripheral vision, extended just a little forward of his position and then immediately disappeared. The flash was accompanied by a shock

Aerobits

wave and muffled bang. Lead was unable to contact No 3 and turned in a right, climbing orbit over the vicinity of the flash. He switched to Guard, began squawking emergency. Position was fixed by ground radar and shortly thereafter the flight departed for home.

Investigators reported that Lead failed to comply with existing directives requiring use of all available navaids. They attributed the probable cause of off course track to failure of Lead to apply the effect of existing winds at altitude and during letdown. Timing errors were suspected as well. Other possibilities were enumerated in the report.

In summary, the board opinioned that the flight leader made serious navigational errors and descended IFR to just above the terrain. No 3, for some undetermined reason, departed the flight, turned away from Lead and crashed into the hillside. They further stated that 60-16, Command and Wing directives, Wing and Squadron policies were violated in the planning and conduct of this mission and are considered definite cause factors.

F-4C BLC MALFUNCTION—On the third touch and go landing, after an hour and 30 minutes of flight, the BLC malfunction light illuminated as the flaps were retracted to the full UP position. The pilot immediately throttled back, lowered flaps to the full DOWN position and landed without further incident. Maximum time with BLC light and flaps UP was five seconds or less.

Investigation showed heat damage to the flap trailing edge, and four one-half inch rips in the forward edge of the flap where it had jammed into the wing top surface rather than under the wing surface. An actuating rod connecting the flap to the bell crank had broken. ☆

FALLOUT continued

it the HSI and they gave it to us. We like it and think everyone ought to have one. But as long as we are stuck with radials, wouldn't it be nice if the thing had a tail on the needle?

Lt Col Norman H. Frisbie

Maj Robert F. Pugh

Capt John D. Musgrove

Capt. William R. Seal
836 Air Div (TAC)
MacDill AFB, Florida

RADIALS??

I have just read Colonel Fussell's letter in the January issue of AEROSPACE SAFETY. I'm all for someone who wants to tell a pilot to steer in the direction in which he should be headed, rather than to use the reciprocal of the direction he would be headed in, if he were headed the other way.

By all means, let's do away with radials! More power to the Colonel.

Lt Col H.H.D. Heiberg, Jr
7205 Leesville Blvd
Springfield, Va.

GUARD CHATTER?

About your attempts to reduce non-emergency radio traffic on 243.0 mc: recently I overheard a century series jet pilot carrying out a practice intercept and using 243.0 as a control frequency because he had lost his primary frequency. He carried out the intercept that he was involved in and then asked for another. In all, he used Guard for 20 minutes with constant chatter, rarely identifying himself and using pretty horrible radio procedure.

Later I telephoned the control station and talked with the Operations Officer. He readily admitted that his unit had used Guard and that there was no emergency. In fact, the jet with the radio failure was one of a flight of five in excellent weather. Throughout our conversation, I got the impression that he thought nothing was wrong with using Guard as a communications backup.

I was over 200 miles away at low altitude and heard the aircraft clearly. It is a fortunate thing that no aircraft experienced a real emergency throughout this 20-minute period in an area of over 132,000 square miles.

It's bad enough that pilots use Guard for non-emergency transmissions, but for a controller to condone it for 20 minutes is unheard of. Naturally, my CO filed a violation with the FCC.

Lt Henry C. Rayburn, USCG
USCG Air Station
Traverse City, Michigan

WELL DONE

MAJOR CHARLES A. GABRIEL **MAJOR SCOTT G. SMITH**

1001ST AIR BASE WING, ANDREWS AFB, WASHINGTON, D.C.

Majors Gabriel and Smith accomplished an outstanding feat of airmanship by working as a team to successfully execute a flameout landing with two landing gear only partially extended.

The flight in a T-33A was one leg of a proficiency cross - country. Takeoff was made at Little Rock AFB with Biggs AFB as the destination. The flight at 39,000 was uneventful, until an explosion occurred in the aft section one hour and thirty minutes after takeoff. The pilots, with the help of radar determined Carswell AFB, 35 miles away to be the nearest suitable facility and headed there. The weather was clear with unlimited visibility, and all electrical equipment except for radios was turned off. Major Gabriel and Major Smith arrived over the field at 25,000 and attempted to lower the gear using the normal system. The gear did not indicate down and locked so the emergency system was used, but to no avail. At 20,000 feet the radio failed. Use of the left rudder pedal after the explosion produced no results, and the pilots applied left rudder by pulling out on the right rudder pedal. Continued use of the emergency hydraulic pump failed to produce a safe indication. A forced landing was made on the runway, but the left main gear and the nose gear collapsed shortly thereafter, and the plane skidded off the runway where it came to a halt after turning 90 degrees. The pilots evacuated the aircraft with no further incident.

Major Gabriel and Major Smith handled this emergency situation in an outstanding manner and in so doing, limited damage to the aircraft. WELL DONE! ☆

SUCCESS STORY

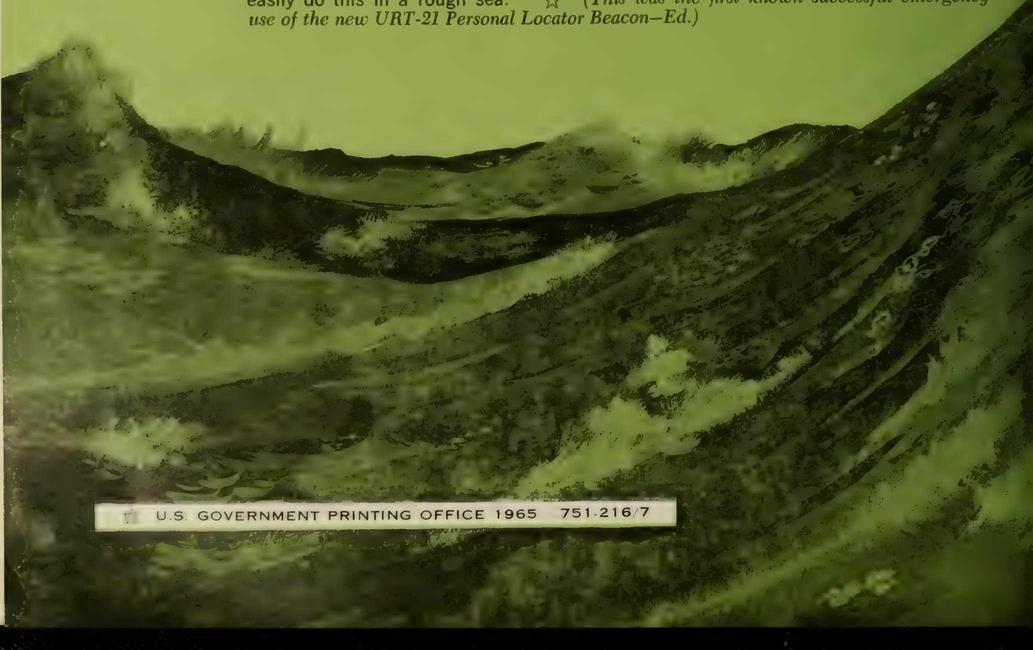
"The ejection sequence went according to the book. I pulled the visor down on my helmet and cinched the chin strap. I put the aircraft in a wings level climbing attitude, airspeed 200 knots, and lifted both ejection handles. The canopy left the aircraft. Although the windblast was quite noisy, I felt no sensation of force in the cockpit. I assumed the ejection position and squeezed both triggers. The upward force of the seat was not extreme but the windblast and deceleration were quite violent. I had the sensation of tumbling forward at a great rate, but my wingman later stated that I made only one rotation backward before separating from the seat. The deceleration must cause this feeling. The man-seat separator worked as advertised and I felt it pushing me from the seat. I had connected the zero lanyard at the TACAN initial approach fix, resulting in the chute deploying immediately. The chute opened cleanly and I found myself, uninjured, floating down to the Pacific.

"During the descent, I inflated the underarm preservers, actuated the seat kit, opening the life raft, took off my oxygen mask and flying gloves, threw them away, and opened the safeties on the parachute quick releases. The descent was very peaceful and it seemed to take a long time to come down (ejection altitude 3000 feet). Before I hit the water, a flight of four aircraft appeared and started to circle my position. Their presence, along with my wingman capping, assured me of a quick rescue.

"As I hit the water, I released the left riser and spilled the chute before it could drag me. The second release was easy to operate and the chute drifted away. I closed the quick releases, got into the raft, and pulled up the survival package, fishing out the URT-21 beacon and a few flares. My CWU-10/P exposure suit leaked a little around the fly zipper but, although the water was only 45 degrees, I remained warm and comfortable until my pickup. I normally wear a set of thermal waffle weave underwear under the nylon suit liner. I believe that a man, uninjured, and clothed like I was could last a night at sea in his raft in the winter here. The gloves supplied with the suit were unsatisfactory, being practically impossible to get on with their tight wrist seals. I would recommend fitting them much looser or removing the seals altogether.

"The H-43 arrived on the scene about 20 minutes later, tracking in on my URT-21 signal. When I saw them coming, I lit one of the red smoke flares and they flew directly toward me. They lowered an aluminum basket rather than the usual horse collar and I needed only to roll into it from the raft. The winch operator signaled to cut loose the raft and survival kit, which I did, and hoisted me in. Twenty-five minutes later, I was standing on the ramp at my home base.

"Comment: I broke the antenna on my URT-21 while getting into the rescue basket. It is made of soft aluminum and is easily bent. I can see how a pilot could easily do this in a rough sea." ☆ *(This was the first known successful emergency use of the new URT-21 Personal Locator Beacon—Ed.)*



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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

MAY 1966

T-TAILS see page two

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AEROSPACE SAFETY

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AFRP 62-1 MAY 1965 VOLUME 21 NUMBER 5

FALLOUT

APPROACH END ENGAGEMENTS

Your article in the March issue on approach end engagements is excellent. The tests conducted by Wright-Patterson and Edwards AF Bases resulted partly from a request originating from the 5th Air Force in 1963 when the flight safety shop became aware of the possibilities of the approach end engagement to lessen the severity of a potential aircraft accident.

The conclusion that the touchdown point should be 450 feet in front of the barrier corresponds practically to ours at Fifth Air Force. We recommended 600 feet. As a pilot I would have to ask myself if I could gauge 450 feet from the barrier, particularly when under stress.

I recommend that bases with BAK-6 or BAK-9 barriers be instructed to paint a distinctive mark on the runway which a pilot contemplating an approach end engagement could use as a guide. This instruction should be incorporated in AFR 91-17, National Standard for the Marking of Serviceable Runways and Taxiways.

Maj Bradford L. Benson
Chief of Safety
Bangor Air Defense Section, USAF
Topsham, Maine

This sounds like a good idea. Your suggestion has been forwarded to AFOCE for their consideration.

WHAT HAPPENED?

SEE PAGE 22

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. In discussing unusual attitude recovery procedures, AFM 51-37 states on page 9-3: "If you are climbing, add full power and roll, or continue your roll, to bring the bank index pointer toward the nearest 90-degree bank index mark." Does this mean that you must roll to 90 degrees of bank? Does this require some degree of roll for all aircraft?

A. The answer to both of the questions is no. The use of bank will aid pitch control, however, the amount of bank used should not exceed aircraft limitations. When recovering from a steep climb, some aircraft may have to sacrifice the aerodynamic assist of bank due to aircraft limitations.

Q. Reference: "Point to Ponder" in the January issue. Under circumstances where radio failure occurs prior to receiving a clearance into the high altitude route structure and the pilot climbs to maintain the lowest cardinal attitude in the highest structure filed, or MEA, what consideration is given to the lowest *usable* flight level? (Example: Departure altimeter setting is 28.38 - lowest usable flight level is FL 200.)

Captain John L. Bristow
Chief, Flight Test Section, AFLC
Liaison Office, Greenville, Texas.

A. The problem does not affect the pilot because he should follow normal procedure. This procedure is to climb to Flight Level 180 as stated in FLIP and maintain this altitude to destination. Air Traffic Control will take into consideration the low altimeter setting and will provide the necessary separation from other aircraft under their control. You can avoid this situation altogether if you will not accept the clearance until Air Traffic Control specifies a flight level plan that satisfies your flight plan requirements.

Q. We would like to know whether the altitudes depicted on the FLIP terminal charts are mandatory altitudes or whether they only serve as a guide as long as the minimum safe altitude is not violated. *Major Ralph J. Maglione, Hq USAFE.*

A. Unless otherwise noted on the FLIP terminal charts, the altitudes depicted are minimum altitudes to comply with obstruction clearance criteria stated in JAFM 55-9 or to separate approach traffic from underlying air routes.

POINT TO PONDER

Recently a situation was brought to our attention that we feel deserves mention. A pilot was flying a precision radar approach; weather was 200 feet and one-half mile. His lost communications instructions were to proceed to the VOR and execute the published approach. The conflict is pretty obvious, isn't it? Since the weather was 200 and one-half, the pilot could not attempt a non-precision approach of any kind.

SERVICE TO YOU

One of the missions of the USAF Instrument Pilot Instructor School is to standardize and promote techniques of instrument flying in the Air Force. To assist in this effort AEROSPACE SAFETY magazine features this page developed by the IPIS in order to aid the flow of information.

IPIS wants your questions and comments on all aspects of instruments, navigational aids, weather, flight planning, regulations and publications, procedures, techniques or any other area.

The value of this page is up to you, the reader. Send your questions to either of the following: ***Air Training Command, Attn. IPIS, Randolph AFB, Texas, or Editor, AEROSPACE SAFETY Magazine, Deputy The Inspector General, Norton AFB, California.*** ☆

It isn't too difficult to see in print that a problem would exist in such a situation. The problem lies in the fact that a pilot on instruments in weather may become so preoccupied with the job at hand that he will accept such instructions without hesitation.

There are two factors to consider when lost communications instructions are received: First, do you completely understand the instructions, and second, are the instructions such that they can be safely complied with?

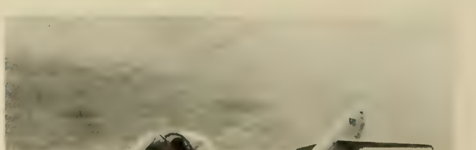
Another tip on planning. Ever gone into a strange field in bad weather expecting to fly a precision radar approach only to be told "Radar temporarily out of service"? Usually a frantic scramble for the terminal charts is begun and a silent prayer (or curse) is muttered in the hope that the depicted approach can be figured out in the few minutes left before station passage occurs.

If you have sufficient fuel remaining, one solution might be to request holding until you feel ready to begin the approach. Unfortunately, this may not be possible.

Obviously the best way to prevent this kind of confusion is to be familiar with the various approaches to the airport well in advance. This is one part of preflight planning that is often sadly neglected and which adds to the confusion of the pilot, the irritation of approach control, and frustration of other traffic in the vicinity. An extra few minutes spent in Base Ops studying the charts can pay off real dividends.

T-Tails

By Capt John A. Morrison
Aerospace Research Pilot School, AFFTC
Edwards Air Force Base, California



The MIG-15 was one of the first jet aircraft designed with the high-tail, swept-wing configuration to meet performance requirements. Its control characteristics often shook-up its pilots.

The MIG-15's entry into the Korean War opened a new era in the age of aviation. The great advance in performance over WW-II aircraft introduced new problems for the pilots involved in jet versus jet aerial combat. The MIG also brought with it some stability and control characteristics that gave its pilots a bad time. On several occasions the MIG was seen to "dig in" or "pitch up" during a high G turn. At least two confirmed victories over the MIG were attributed to the airplane entering an uncontrolled maneuver from a hard turn.

Ten years later "pitch-up" is still a fearsome characteristic. There are a lot of aircraft flying today with pitch-up possibility. Pilots of these airplanes use caution and avoid the area of pitch-up because of the resulting uncontrolled maneuver.

Why is the MIG configuration popular today?

The high-tail swept-wing configuration was dictated by performance requirements. An aircraft so designed will cruise efficiently in the high subsonic Mach range (0.85 to 0.95). Wind tunnel tests of the XF-104A showed the high tailed configuration to have lower overall drag than any other configuration.

A sweep angle of 30 to 35 degrees will increase the speed at which the drag-divergence occurs due to Mach number (Fig. 1).

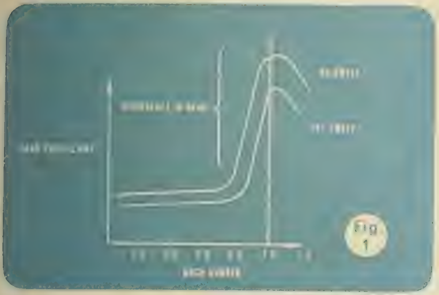


Fig 1

The delay in drag-divergence becomes the most important design criteria for flight at high subsonic speeds. If the tail is up high out of any airflow interference, it will be more effective. The higher degree of effectiveness will allow it to be physically smaller with a smaller thickness to chord ratio. Thus the parasite drag and the induced drag of the tail will be less. The airplane will cruise at a higher Mach number using less power and its overall range, endurance and rate of climb will be better. Thus, economics play a deciding role in the basic aircraft design.

The increase in performance doesn't occur without penalty; the high-tail aircraft configuration has a pitch-up possibility. Both the swept-wing and the high-tail contribute to the aircraft instability, the wing because of its airflow patterns. The pressure gradient along the wing surface causes span-wise slipping of the airstream (Fig. 2). This produces a thicker boundary layer of air near the tip. Air flow separation will occur first at the tip and thus the stall occurs first at the tip.

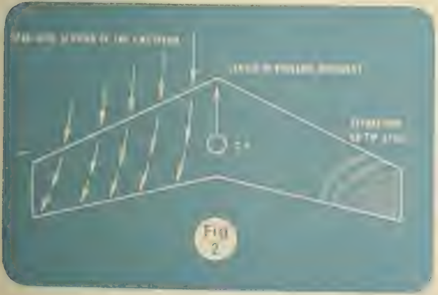


Fig 2

The wing tip stall causes the center of pressure to move forward. As the center of pressure moves forward the moment created is a nose up moment.

Airfoil and control surfaces at the rear of the airplane are used to stabilize and control the moments on the airplane. The horizontal stabilizer gets its name because of the function it performs. By virtue of its position behind the wing, it operates in airflow from the wing. Airflow over the wing is deflected up by the shape of the wing. This air must come back down and this change in airflow pattern is known as downwash (Fig. 3).

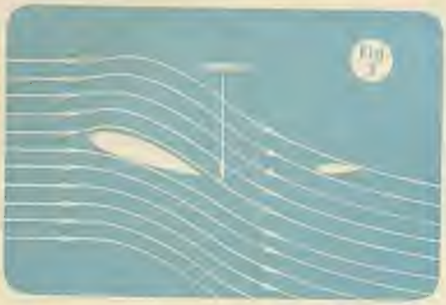


Fig 3

An airplane moves through the air fast enough so that the deflected air is still on its way down when it arrives at the tail. As a result, downwash reduces the angle of attack at the tail. Also, the amount of downwash at the tail will increase as the wing angle of attack increases, and an increase in downwash has a destabilizing effect.

When the airplane wingtips stall, the wing vortex shifts inboard increasing the local downwash at the tail (Fig. 4). At high attack angles (approaching stall) the airflow across the fuselage separates and the resulting vortices also increase local downwash at the tail (Fig. 5). Thus the tail suffers a decrease in effectiveness and stabilizing ability as the airplane angle of attack increases.

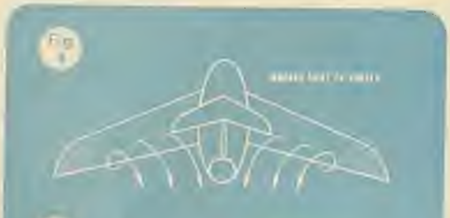


Fig 4

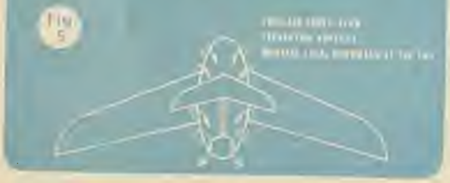


Fig 5

By placing the tail high enough it can be kept out of this region of downwash and it will not show a decrease in effectiveness with angle of attack. But if it moves from an area of no interference to an area of

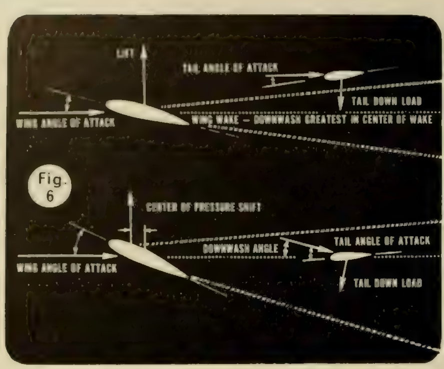


Fig. 6

strong downwash (Fig. 6), then a sudden and significant loss in stability can occur. The angle of attack at which the tail enters the downwash area is determined by the height of the horizontal stabilizer. However, since the vertical distance is limited by the structure of the vertical stabilizer it is practically impossible to get the tail high enough to avoid the pitch-up region completely.

The pilot can fly the airplane into this region in several ways: (1) slowing down while holding altitude, or (2) holding a high pitch attitude as the rate of climb decreases, or (3) as is most common, tightening a turn as the airspeed bleeds off. The latter is what happened to the MIG-15 pilots. Those fellows usually had their attention to flying distracted by a Sabrejet behind them. The MIG's immediate survival depended upon its ability to turn. So the pilot kept pulling it in and suddenly without much warning, "pitch-up!"

The unstable flight regime that exists in this aircraft configuration establishes a control limit for the airplane. Trying to fly the airplane in this region is just as foolish as trying to fly a low tail airplane past its stall limit.

If we examine a plot of pitching moment versus lift of the high-tail, sweep-wing airplane we can see why it is that the aircraft can suddenly pitch nose up. Technically we apply the term "pitch-up" to a longitudinal static instability that can occur with this aircraft configuration at high angle of attack. The plot of pitching moment coefficient versus lift coefficient shows a stable region for low values of C_L and a transition to an unstable region at high C_L's. The unstable region is caused by the horizontal stabilizer being moved into an area of strong downwash (Fig. 7).

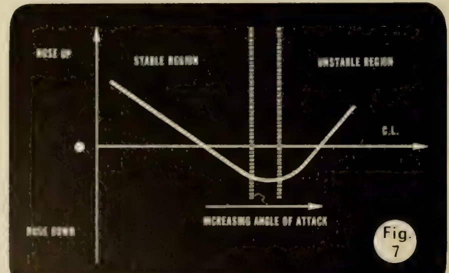


Fig. 7

The slope of the Cm versus C_L curve indicates the longitudinal static stability level of the airplane. If the airplane is flying in equilibrium in the stable region and experiences a nose up disturbance the resulting increase in C_L indicates a nose down moment is created. Thus there is a tendency to return the airplane to its undisturbed position. Conversely, if the disturbance occurs with the airplane in the unstable region, the moment created tends to reinforce the nose-up disturbance, hence the instability.

The static stability of the airplane is obvious to the pilot during normal flying. If the airplane is trimmed for cruising flight and the control column is bumped or the airplane flies through some air disturbances, the static stability is indicated by the tendency of the airplane to return to its undisturbed position. If the airplane did not come back toward the original position, but rather continued to pull up similar to a loop, then the airplane would be statically unstable.

The plot shows the high-tail, swept-wing airplane to have an angle of attack area where the airplane becomes unstable. The suddenness and severity of the instability depends upon the design of each particular airplane. If the longitudinal control were adequate and entry into the unstable area slow enough, a good pilot could fly the airplane out of this region once he noticed the nose starting up.

The MIG-15 entered the unstable region without warning. The pilot soon discovered the maneuver was violent and beyond his control. Operational use of this aircraft was a dilemma. The MIG pilot had two choices. Stay out of the high C_L region and get shot down or use the region and if pitch-up occurred, use the published recovery technique. His published recovery technique leaves a little to be desired by our standards. He had a white line painted vertically on the center of the instrument panel. In the event an uncontrolled maneuver was entered, he was to hold the stick on the line. If the airplane did not recover, he would bail out. The pitch-up characteristic was the price the MIG-15 paid for its performance.

There are many aircraft today with a similar configuration; among them the USAF F-101 Voodoo, F-104 Starfighter, C-141 Starlifter, BAC 111, Boeing 727 and the Douglas DC-9. The airplanes are fitted with warning devices to tell the pilot when he is approaching the unstable region. Horns and stick shakers are such devices. In addition, the control systems incorporate devices to automatically push the stick forward in order to prevent inadvertent entry into the pitch-up. The pilots are provided sufficient control authority so they can "fly out" of an approach to the instability.

These modern airplanes are fool-poof; but they're not damn-fool proof and it still requires the pilot to have knowledge of the stability and control characteristics of his equipment. He must know his operational limitations and keep his attention on the business of flying. ☆

HOW ABOUT YOU?

This article was written within a short time of the event related, while the experience was fresh in the pilot's mind. If you've never been hypoxic outside an altitude chamber, read on. These words might be your life-saver.

By Capt William J. Starr, Hq 9th Air Force, Shaw AFB, S. C.

Once every three years I, like all other pilots, go to an altitude chamber and carefully learn what my symptoms are at the onset of hypoxia. Mine are quite definite, always the same, and leave little doubt in my mind that I am hypoxic – when I'm in the chamber, that is.

Today, however, in a trusty old T-Bird, I got my symptoms again. As we leveled off at FL 240 (16,000 feet cabin pressure) I felt sick. My pulse was very rapid. I was breathing fast and there should have been no question in my mind that I was hypoxic. I automatically went to 100 per cent oxygen, but that didn't help. In fact, I seemed to feel worse. Do you know what my next thought was? I thought we had contaminated oxygen.

I pulled my mask off my chin and tried breathing cabin air. No change. Then I made another brilliant deduction. I must be hyperventilating since I was breathing so fast. So I held my breath. The only trouble was, I couldn't seem to hold it for more than a few seconds. I thought that was very strange since I knew that when you are hyperventilating it should be easy to hold your breath for a considerable time.

While all this was going on, I had been responding to radio calls from the ATC center. I had made a frequency change involving setting up a manual frequency. I had even received and acknowledged a route change and repeated it to the pilot in the back seat, who had missed it.

Finally I decided that I definitely had some contaminated oxygen. I went back to normal oxygen and pulled the mask off my chin again, wondering if the transient crew had put nitrogen in our oxygen system. I wondered what other contaminant could have found its way into the oxygen which would be odorless, as I smelled nothing unusual. I debated calling our departure base to warn them of this potential killer they were passing out. But I never said a word to the jock in the back seat about my difficulty or about my conclusions. It never occurred to me that he was breathing the same oxygen as I.

Well, for some reason I started feeling better after a few minutes. I was very relieved and not just a little proud of the way I had solved the mystery. I was holding my mask off my face except when I had to talk on the radio. The back seat pilot was flying the bird all this time and I started checking radio frequencies.

A few minutes later, I very suddenly felt bad again. All the symptoms returned. I felt close to passing out, and loosening my mask didn't help a bit. At that point, finally, I thought of hypoxia. I checked my blinker—nothing. I took a deep breath—still nothing. 100 per cent—still nothing. Finally, when I realized what was wrong, I reacted. I told the other pilot I was in trouble. I told him I was definitely hypoxic. (I guess I wanted to make sure he didn't get off on my tangent about contaminated oxygen.) I said something about descending and started pulling my bailout bottle handle.

I started feeling better quite fast, although I think my vision was considerably reduced for a few seconds. We leveled off below 10,000 feet and I soon found the source of my trouble. The aircraft oxygen hose had pulled off a fitting down by the left side of my seat. I had checked my oxygen system prior to starting so I know the hose was connected then. I suspect the hose had pulled loose during a subsequent seat adjustment. Route changes, NAVAID troubles, clearance changes, etc., prevented me from noticing the malfunction during the 5000 foot and 20,000 foot checks.

So what is the point of this little tale? I have learned that I can experience all the symptoms of hypoxia, the same ones I have so carefully learned in the chamber, and never realize that I am hypoxic. I have learned that my judgment can be so severely impaired that I will remove my mask to avoid breathing *contaminated* oxygen but never mention it to another pilot using the same oxygen supply. I have learned that I can *recover* from hypoxia only to suffer a relapse far more rapid and acute than the original attack. Most important, I have learned that thorough and frequent oxygen checks may save my life.

How about you? Will you take my word for it or will you wait until you learn the hard way? ☆

Dangerous Cargo

Suppose you've just turned in your 175 and filled out an RON message and are waiting for the crew truck driver to return from chow so you can go to the VOQ. A sergeant comes up to you and asks if you'll have room for about 300 pounds of cargo in the morning. It is destined for your base and it will sure help if you can take it.

Sure you have. Just see that it is aboard and secured by 0730. You always feel better when space isn't being wasted.

Comes the dawn, and with it the pounding on the door in response to your note left on the wake-up sheet. At Base Ops you file and are told. "Some sergeant put about 400 pounds of cargo on your bird. Said he'd checked with you."

"Right. He cleared it with me last night."

No problem. Thirty minutes later you're winging your way toward home and a hitchhiking passenger comes forward, coughing slightly, and tells you the back end of your Goon "don't smell so good."

He's right. When you go back to inspect you find strange odors emanating from the cargo. There are fumes, too, quite irritating to your eyes, nose and throat. You go forward, close the door, invite the young army troop to stay forward and act like he's a crewmember and buckle in. "Joe," you say to your copilot, "get us — cough — a clearance — cough — back. There's — cough — something leaking — from that cargo."

So you go back and land, your Good Samaritan attitude dented somewhat. And in Base Ops, discussing your problem with the flying safety officer, you learn there are regs and manuals that cover this sort of thing. Further, the ser-

Graphic evidence of what dangerous cargo can do.

geant who put the stuff on board and some vague "someone" doesn't get all the blame. You, mister pilot, have a responsibility, too. The FSO invites you upstairs and his ground safety sidekick pulls out AFM 71-4, which defines dangerous material: **any material which by virtue of its properties is flammable, corrosive, combustible, an oxidizing agent, explosive, toxic, radioactive or unduly magnetic.**

Because of the incident and possible culpable liability on your part you read on. Here's an out for you: A pilot assigned to the operation of an aircraft on which dangerous materials are scheduled for shipment will be notified during or before loading and he will initial entries made of such dangerous materials on the manifest. He will also be briefed by the local transportation, medical, ordnance or safety personnel as appropriate, regarding the properties of each dangerous material, its proper handling, first aid, and measures to be taken in the event of an inflight emergency. It will be the responsibility of the transportation officer to arrange for qualified personnel from his or other departments to acquaint the pilot with the dangerous materials to be loaded on his aircraft. Aha! That let's you out. But when the safety guy points out that freedom from fault is little consolation when you're dead you lose some of your enthusiasm.

You read on: All dangerous materials will be stowed in such a manner that they will be easily accessible in flight without moving other cargo. Farther down you note: When materials, whose vapors are toxic, irritating or corrosive are a part of the cargo, all personnel will have in their possession personal protective equipment of a type approved by the Medical Facility and Ground Safety.

You read on, and learn more: When any item of cargo has properties presenting a fire or explosive hazard, smoking and ignition of matches or lighters in the cargo compartment is prohibited. Further, it is the responsibility of the aircraft commander to see that this requirement is met.

There's lots of good stuff in chapter one. On with the manualese.

Certain materials as indicated by their freezing points must be protected against freezing.

All packages of dangerous materials will show on the container the proper item name.

A separate shipping document will be furnished for explosives and other dangerous materials when other general cargo is transported on the same aircraft.

Metal containers of liquids or gases showing any signs of corrosion or any dents at a seam, soldered or welded area will not be accepted for air shipment.

Under some conditions major air commanders can authorize deviations, provided each aircraft commander is thoroughly briefed as to identification, dangerous properties, and location of dangerous materials.

Dangerous materials will not be offered or accepted for transportation by air unless the shipper or his authorized agent has certified on the shipping document that the shipment complies with the requirements of this manual.

The phone rings; the FSO answers and turns to you and says, "Your bird is all set to go again. No cargo this time."

You close the cover of the manual, checking again to be sure you know the identification—AFM 71-4.

"Here," the ground safety technician suggests, "I'll jot the reference material down for you. Paragraphs 1-2 through 1-6 of 71-4 are especially important." He writes down some more numbers. "You might want to check AFM 71-6 and MATS Manual 55-1 also has information of value."

"Thanks." You pocket the memo. "I'll check these when I get back."

On the way down the stairs the FSO has a final suggestion. "Why don't you report your experience to your safety office. This would be a good matter to bring up at your next safety meeting. It can be anonymous—just so the word gets around. You might save one of your buddies."

"Yeah, I'll do that." ☆

The accompanying picture shows the belly of a C-124 after an attack by dangerous cargo. Here's what happened. The aircraft departed an east coast base early on a May afternoon in 1960 on a routine cargo run. On board were more than 32,000 pounds of miscellaneous cargo, including 860 pounds classified as dangerous. Approximately one hour after takeoff, at 7000 feet, fumes were detected in the rear of the aircraft just aft of the elevator well where the dangerous cargo was stored. It was found that the wooden box containing the hydrochloric acid was leaking badly. An emergency was declared and the pilot landed at the nearest Air Force base. Time from discovery of the fumes and landing was approximately 20 minutes. Immediately after landing the crew deplaned and observed that holes were appearing in the skin at the bottom of the fuselage aft of the elevator well and, in addition, stringers and formers were showing. A laboratory was contacted for information necessary to neutralize the corrosive acid. The aircraft was then washed down with water to dilute the acid and dry soda was spread over all accessible contaminated areas to neutralize the acid. Later, after the aircraft had been flown to its home station by the chief of maintenance, it was discovered that the acid had not been entirely neutralized and a vinegar and water solution was sprayed over the contaminated areas in an effort to further reduce the corrosion. The aircraft was then flown to a contract repair facility.

A glass carboy had broken, allowing the acid to leak into the airplane. Inspection of the broken glass carboy disclosed flaws in the glass. ☆

AN ENERGY

APPROACH TO LANDING

**By Don Stuck, Experimental Test Pilot,
McDonnell Aircraft Corp
(Reprinted from "Tiger Talk")**

In looking at landing accidents of all aircraft on which we could dig up information, there appear to be a couple of trends that I feel are significant.

First — the accident rate seems to be tied pretty directly to the energy level of the aircraft at touchdown.

Second — the ratio of preventable to non-preventable landing accidents increases as a function of energy level also.

What this means to me is that the aircraft with the combination of higher weight and higher final approach speeds has the best chance of having an accident. I can't believe that people who fly slow, light aircraft are as a group better pilots than those who fly heavy, fast ones. So my assumption is that for a given number of "boo boos" in the landing phase, the heavy-fast pilot gets caught easier and more often than his light-slow brother pilot.

You might say that today's fighter pilots are not only sitting on a bigger "hand grenade" than the gooney-pickle pilot, but it's got a shorter fuse to boot.

There's nothing the pilot can do about the design weight and touchdown speed of the aircraft he's flying, but is there anything he can do about reducing the accident rate in the landing phase? You bet there is! It all centers around techniques which hold energy levels to be a practical minimum at touchdown and dissipate this energy during the landing roll in the most efficient manner.

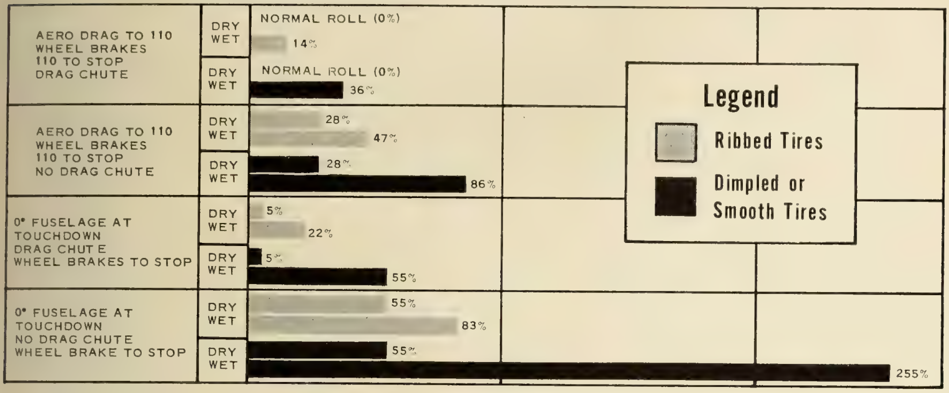
Energy is a function of weight and speed. I'm not going to try to impress you by writing a bunch of formulas because it isn't necessary to know them and I'm liable to get them wrong anyway. It is important that you understand the parameters that affect energy, however, so know them well—WEIGHT and SPEED.

Weight affects energy directly—twice the weight, twice the energy—half the weight, half the energy. Speed, however, has a more decided influence on energy. Energy changes as a function of the *square* of the speed—this means twice the speed, four times the energy and half the speed, 1/4 the energy. It becomes readily apparent that it is more important to control speed than weight. This is fortunate since once we commit ourselves to a landing, there's nothing we can do about the weight of the aircraft, but we do have direct control of that other all-important parameter—SPEED.

Although the information in this article applies generally to any aircraft, I will use the Voodoo as an example. Let me throw a couple of fast numbers at you which come close to describing the F-101B aircraft. If you add 15 knots to the final approach speed, you have increased the energy level of the aircraft over eight million foot lbs. This increase might have little meaning to you so allow me to use a couple of everyday examples. That extra 15 knots is equivalent to the energy required to lift a five-ton elephant to a height of 800 feet (for those of you interested in raising animals).

Converting this excess energy to heat—which you

Increased Stopping Distances (F-101B - 35,000 Lbs. - TD Speed 165 Kts.)



do if you make the brakes take care of it—means 10,000 BTU. Once again, here is a number that means nothing to me unless I equate it to something else. This amount of heat will melt 37 pounds of steel which now means hot and a lot of it.

The landing phase is pretty hard to pin down because of the many variables, and the inter-action of these variables. Speed, weight, runway surface, aero drag, wet, dry, tire design, drag chute, etc., all affect the landing roll, but even more important, they affect each other.

There is only one right way to land and stop any aircraft: proper final approach and touchdown, followed by the most effective utilization of decelerating forces available. Techniques vary slightly from aircraft to aircraft and for different landing configurations, but it's all pointed at the same end result: maximum decelerating force working on the lowest possible level.

Let's run through some various landing techniques and conditions to see how they affect energy levels.

The handbook shows a 34,000 pound gross weight F-101B aircraft touching down at 165 knots. This means that the handbook final approach puts you on the ground with about 42,500,000 foot pounds of energy. (That's enough to kick that five-ton-elephant over 4000 feet straight up.)

From this point there is one way, and one way only, to begin the landing roll in the F-101—nose high, aero drag. There is no aircraft configuration, runway condition, tire design, weather condition or pilot frame of mind which does not call for nose high, aero drag during the first portion of the landing roll if you're interested in getting stopped in the shortest distance, in the most efficient and safe manner possible, with the least wear and tear on the machinery.

Since 110 knots is the point where the handbook calls for discontinuance of nose high, aero braking, let's analyse the touchdown to 110 knot portion of the landing roll first.

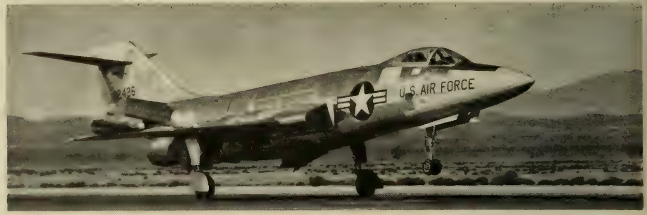
If handbook recommended aero drag is used, the distance required to get the aircraft slowed to 110 knots will be about 1800 feet with drag chute and 2500 feet without. At the 110 knot point our energy level is down to 18,900,000 foot pounds. We have "lost" 23,600,000 foot pounds of energy, enough heat potential to melt 115 pounds of steel, and we've done it without putting one bit of heat into the wheel brakes. Although using wheel brakes instead of aero braking to this point is not the recommended technique, let's do it on paper to see why the decision was made in favor of aero rather than wheel braking.

Above is a chart to show as many variables as I can think of and their effect on the landing roll expressed as a per cent increase over normal dry runway conditions. The numerical values of this chart are realistic everyday numbers but do not fully agree with the handbook for the following reasons:

- The handbook computations use moderate wheel braking whereas my computation uses moderate to heavy braking which is considered realistic with anti-skid protection.
- The handbook incorporates a marked degree of conservatism to take into consideration those pilots who will not utilize the proper landing techniques.

Under favorable conditions it only extends the total landing roll five per cent to use max wheel brakes from touchdown instead of aero braking to the 110 knot point. However, the energy input to the brakes is increased over 200 per cent, which is a lot of unnecessary punishment to the brakes, possibly causing fade, to say nothing of the heat effect on the tires. And all for the dubious pleasure of *extending* the landing roll more than necessary?

Things start getting a little more critical as far as proper landing techniques go when conditions start



getting "tighter." Let's take a drag chute loss for example. With proper technique on a dry runway the loss increases the roll about 28 per cent and increases the energy into the brake about 10 per cent. However, if we don't use aero braking but try to use wheel brakes from touchdown, we increase the roll 55 per cent and the energy into the wheel brakes by 300 per cent.

In the event you're still not convinced, let's go further and lose a drag chute on a wet runway with bald tires. The handbook landing technique will demonstrate an increase of 86 per cent in roll, whereas the "nose down, right on the binders technique" will increase roll by 255 per cent.

From all this I hope it becomes apparent that there are certain adverse factors with which you are likely to be faced on a landing. Within reason there is nothing you can do about the fact that these conditions might be prevalent; however, minimizing their effect on your landing roll is completely up to you. Increase of landing roll due to adverse or semi-emergency conditions is directly affected by landing technique. The worse the basic conditions, the more important it is for you to use the right technique.

Unneccessarily increasing final approach speed follows pretty much along the same line—the worse the conditions, the more that excess speed hurts you. The landing roll is set by the amount of energy you land with and how you "get rid of it." The energy you land with is a function of weight, over which you have no control once you have decided to land, and the *square* of the speed. That extra speed does horrible things to the energy level at touchdown. Keep it where it belongs.

Once you hit the ground the landing roll resulting from your energy level is affected by technique and conditions. Once again you can't do anything about the tire type or runway conditions once you've committed yourself to landing, but you can keep the adverse effect of any condition to a minimum by using the proper landing technique. It's the same, day and night, wet or dry, hot or cold, flaps up or down, chute on or off—it just doesn't change—use it on every landing; it's always the best, safest way to get stopped with the least wear and tear on the equipment.

A research of the F-101 landing accidents shows some beautiful examples of how landing technique alone can be the difference between "no sweat" and "oops!"

If you are interested in a minimum run landing with a properly operating aircraft, good conditions and proper final approach speed as a base point, you can stop in 3600 feet of roll every time. Now let's install bald tires, remove the drag chute and soak down the runway.

These adverse effects will increase your minimum run landing roll 3100 feet if you land "by the book"—nose high, aero drag to 110 knots, then nose down and max wheel braking available to stop.

By the simple (and too often used) change of dropping the nose immediately on touchdown and using max wheel brakes all the way (there's almost none available above 100 KIAS), you can increase the roll 5600 feet. Now add 15 knots to final approach and you can stretch it out another 2000 feet. In the event you haven't added as we went along, we have just taken an aircraft which can stop in a roll distance of 6700 feet every day of the week under the adverse conditions outlined, and by the simple expedient of adding a few knots to final and trying to use wheel brakes from touchdown instead of the handbook technique, with the same aircraft we have gobbled up over 11,000 feet of concrete after it touches down. Smarts a little if you've only got a 10,000-foot runway.

Since I have mentioned the use of maximum braking and anti-skid protection, I'd like to very briefly cover the anti-skid system as installed in the F-101. The system is passive in nature—it contributes nothing nor does it have any effect on braking up to the point that for one reason or another a wheel tries to lock up and skid. The intelligence system of the anti-skid is continually monitoring wheel RPM. When the wheel RPM changes (slows) at such a rate as to indicate an oncoming skid, the system comes into play and dumps brake pressure, even though you have the pedals depressed, and then allows it to be reapplied again according to the amount of pedal you have commanded. It will continue to recycle in an ON-OFF action until the wheel stops showing skid tendencies or you back off on the pedals (commanded brake pressure). The cyclic rate of the system is as required but can be fast enough to prevent detection by the pilot. To prevent any directional problems the anti-skid works on both wheels simultaneously even though only one wheel may be showing skid tendencies.

The anti-skid switch should be left on at all times unless there is a malfunction. It should be considered part of the brake system of the aircraft, which it is. It is interesting to note that no F-101 has been involved in a landing accident caused by anti-skid brake failure. However, I'd have to take my shoes off to have enough digits to count the number of aircraft "crunched" when

You might say that today's fighter pilots are not only sitting on a bigger "hand grenade" than the gooney-pickle pilot, but it's got a shorter fuse to boot.

a pilot turned off the anti-skid because "he thought he could do a better job of getting the aircraft stopped" or "I thought it wasn't working since the aircraft wasn't slowing down very well."

The anti-skid installed in the Voodoo is a very good system, but as you "can't get blood out of a turnip," the anti-skid system can't do the impossible and provide braking where there is no braking capability.

The amount of aircraft deceleration you can command from the wheel brakes depends on an almost infinite number of variables. The only ones of real importance to you as a pilot are the weight and speed of the aircraft, and the runway condition. Take a theoretical case of continual, perfect, maximum braking: At heavy weights there's naturally more inertia to overcome, so the resultant deceleration will be less. Therefore, a stop from an aborted takeoff will naturally "feel different" than a stop from the same speed at landing gross weight. Since we are used to the feel of deceleration from a given amount of brake during everyday landings, it is understandable that a pilot might misconstrue the decreased deceleration force for the same amount of brake applied during an abort as some sort of brake failure or malfunction.

The second item, speed, contributes not only to the basic energy level but also to lift of the wing—the faster the speed the more the lift, the more the lift the less of the aircraft's weight on the gear, the less the weight on the gear the less decelerating force that can be generated by the brake. If you're thinking of increasing the weight on the wheels by "dumping" the flaps, don't! The drag of the flaps provides a higher decelerating force than you could get out of the brakes converting the extra weight on the wheels to decelerating force.

The problem of speed becomes more serious when our third variable comes up—adverse runway conditions.

Contrary to the dry runway condition, the coefficient of friction on a juicy runway decreases inversely with speed. As speed increases not only do we have progressively less weight on the gear, but also the conversion factor of the available weight to deceleration is getting worse.

The whole picture boils down to the fact that there are a lot of variables working on wheel braking effectiveness. The adverse variables all become much more severe with speed. Therefore, the nose high, aero drag technique, which is the best way to get the aircraft slowed to the 110-knot region under good conditions, becomes even more important as the landing conditions become worse. Remember, a wet or icy runway has no effect on the aero braking portion of the roll out since wheel brakes are not even used. If you try to use wheel brakes in this high speed region, they are going to be ineffective for the reasons explained above and the wheel will tend to skid very easily. The anti-skid system will get every bit of decelerating capability possible out of the conditions it has to work with but under extreme conditions it might be next to no decelerating force at all. So, why not use aero drag like you should have in the first place?

From 110 knots on down the over-all wheel braking effectiveness is getting better and, although the wet runway braking is inferior to dry surface conditions, it is still what I'd consider good. Regardless of the runway condition or the aircraft parameters, the anti-skid will protect the aircraft from wheel skid. It cannot, however, put on more brake than you are commanding. So, if under emergency conditions you're interested in getting stopped in the shortest distance possible with wheel brakes, keep enough brake on the aircraft so that the anti-skid is "working." This assures the max wheel brake decelerating force on the aircraft for the prevalent conditions.

From all this I hope you have decided that for any condition the anti-skid should be "on" and you should fly final at recommended speed, land and hold the nose at 10-11 degrees until 120-110 KIAS, then put down the nose and use whatever brake you need to stop.

An emergency or minimum run stop is the same except that the wheel braking portion is done with the brake pedals on the stops—and, oh yes, double check that the anti-skid switch is "on."

For those of you who have never been called upon to make a minimum run anti-skid landing, you'll be amazed at the stopping power available in the brake system of the aircraft. From the time you get the brakes on, you'll only "have time" for about four or five fairly severe-feeling cycles before you're stopped. As the aircraft comes near stop, you'll want to ease off the brakes a tad to prevent gear chatter.

In closing I would like to ask the impetuous ones among you to please refrain from using this article as an excuse for making your next landing a minimum run, full anti-skid just for kicks. Rather, use it as a basis of discussion of the landing phase of the aircraft and the capabilities and operation of the brake system. A lot of Voodoos are missing from roll call because of a lack of complete understanding in these areas. ☆

Pilot-Forecaster weather information is a . . .

Two Way Street

By Lt Anthony Williams, Det 6, 9th Weather Sq, Malmstrom AFB, Montana

We in Weather deal in a service. The surprising thing is that weather is only half of that service. A satisfied customer is the other half. To most forecasters it is easier to put out a forecast than to give the actual briefing on it — especially in bad weather.

Here is where our two-way street enters. The best way to illustrate it is to set up a hypothetical pilot-forecaster situation. Some or all of these incidents have happened to you at one time or another when receiving your weather briefing.

Fcstr: What can I do for you?

Plt 1: How about filling out my weather data sheet?

Fcstr: I see you've left off your ETA, ETE, and altitude.

Plt 1: Let's see, it's 1430Z now. We'll be off at 1500Z and I'll give you our ETE and altitude as soon as you give me the altitude for best tail winds and how strong they are.

Fcstr: The altitude for best tail winds is 40,000 feet, 290 degrees at 180 knots for an average.

Plt. 1: How about the 10,000-foot winds? You see I'm flying a U3A.

Fcstr: I'm sorry, sir. I didn't look at the 175 close enough. The 10,000-foot wind is 290 degrees, 50 knots.

Plt 1: Let's see, that means three plus thirty enroute.

Fcstr: EXCUSE ME, Sir, I have to put out a SAGE Trend forecast.

Plt 2: (Busting in) Excuseme,butwhat'sitgoingtobeinthelocalareatomorrowat1000?IhaveastandboardandIneed1000localtakeoffdata,surfacewinds,temperatureindegreescentigrade,dewpointindegreesfahrenheit,specifichumidity,climbwindsto10,000feet,temperaturedeviationduringclimb,flightleveltemperatureanddeviation,and10,000footwindswithinfiftymilesofMalmstrom.I'minahurry!

Fcstr: One moment, sir. I'll be with you as soon as I finish a SAGE Trend Forecast and this gentleman's 175.

Fcstr: Sir, the Omaha forecast is 5000 broken, 25,000 overcast, 10 miles visibility with light rain showers, winds two zero zero at 15, altimeter 29.65.

344.6: Great Falls Metro! Great Falls Metro! This is Boo Boo 11, over.

Fcstr: Excuse me, Sir . . . Boo Boo 11, Malmstrom Metro, over.

BB 11: Ahhh . . . Malmstrom Metro, 11. We're entering the Lazy Susan Oil Burner Route at 2200Z and would like forecast altimeter setting, D values, and any significant route weather.

Fcstr: Roger, 11, Lazy Susan at 2200Z. Stand by, over.

BB 11: Roger, 11.

Fcstr: (To himself) Where in creation is Lazy Susan? He wants a forecast for about eight hours from now. This is gonna take at least five minutes and I have two pilots and a TAFOR to get out. HELP!

Plt 1: Say, how about back here about midnight?

Fcstr: No sweat!

Plt 1: Well . . . O.K. . . . Thanks.

ANALYSIS — Both the pilots and the forecaster showed less than adequate communication technique. The forecaster should always look the 175 over carefully to know what the pilots desire. The pilot should expect to have delays during his weather briefing and should plan to accomplish as much preflight planning as possible before handing a 175 to the forecaster.

An incomplete 175 may not be spotted by the forecaster. He may not pick out operational stops, enroute delays, etc. If you have not completed your sections of the 175, please bring it to the attention of the forecaster. It may save his time and yours.

A forecaster has priority of duties and a 175 is down on that list quite a ways. Be patient with him if something comes up that interrupts the briefing.

Sometimes he may do some lower priority duty (such as answering Plt I the last time) or answering the telephone. These things will only be done if, in his judgment, it would be more expedient to remove that problem than to have someone wait a long time on a very simple question.

If your request would take a large amount of time, please keep in mind that a higher priority request may occupy his time before your request is dealt with.

When receiving the actual spoken briefing, a pilot should expect the forecaster to give:

- Takeoff data
- Climb weather
- Enroute weather
- Descent weather
- Destination weather
- Alternate weather

If all of this information is not received, ask for it. If the briefing is interrupted often, ask to have a complete repeat so that the full flight picture can be seen.

If the pilot wants an outlook for a return flight or some future flight, expect a general answer from the forecaster. If, however, the answer does not satisfy you ask for clarification.

Some pilots would be insulted if the forecaster gave a very formal, finely pinpointed forecast for an outlook. The "scattered Cu," "broken middle clouds," or "no problem" answer may be too informal and lack the preciseness the pilot wants. Please clarify any doubts you may have. He doesn't want you to walk away half satisfied. ☆

BULLDOGGING the BULLPUP

By Major H. M. Butler, Directorate of Aerospace Safety

Down at the County Fair and Rodeo the other day, there was a real fine demonstration of precision and professionalism. I first noticed a group of cowboys huddled near the chutes and at a casual glance they appeared completely relaxed, but you could tell they were intent and not one word the leader said was missed.

When they mounted their horses and began warming up, you could easily tell that each man knew precisely what to do, how to do it, and when to do it, indicating constant instruction and persistent practice. With the public address system announcement of the first bulldogging event, this team wheeled into position with the smoothness of a panther stalking its prey. The bull was turned out of the chute and the team sped into exact position and performed each move with the precision born only of strong desire and long practice. Both the men and their horses seemed to anticipate and respond to every move of the bull. The action was so smooth it didn't look hazardous, but a bull's horn in the gut or a broken leg are the constant hazards of carelessness or unprofessional performance in the rodeo arena. In a matter of seconds, the bull was on the ground and the judges' flags went down. This team took the top money.

Now, there is a parallel between bulldogging a bull and bullpupping a Bullpup (AGM-12B). The parallel is the precision, care, and exactness with which each operation must be executed if they are to be safely completed.

There are also some areas in the performance of both tasks where there should be absolutely no similarity. The bull, to be properly dogged, comes plowing to an abrupt halt. The cowpoke twists the bull's grass-eating head until he flops over with his legs in the air and says "uncle." On the other hand the Bullpup, to be properly "pupped," must be carefully handled—no twisting or wrenching—legs must not come off the ground, and the missile must be slid smoothly onto the rails and locked in place.

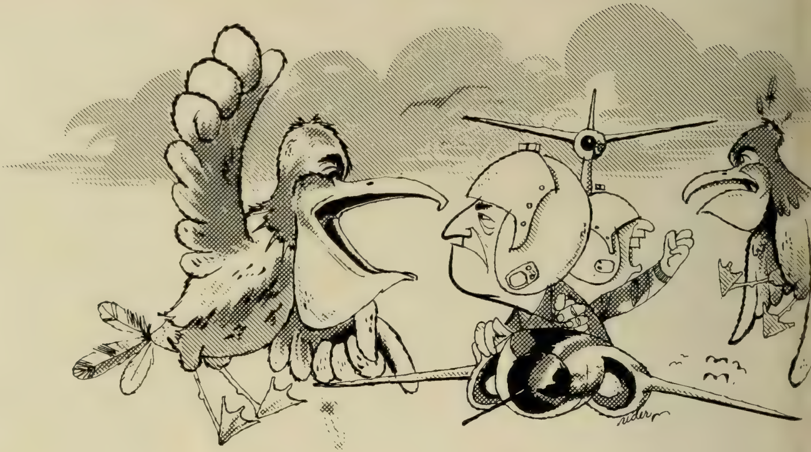
Just recently a bunch of the Bullpup cowboys were whooping it up in the old bunkhouse about how they had really bulldogged a Bullpup. It seemed that like all good cowpokes, they had bunched up and had a briefing (by the checklist) about how they were going to handle this Bullpup.

They had all the steps in order: Desert Pete would unstrap the Bullpup from the trailer; Cactus Joe would take his horse (MJ-1), haze the Bullpup into position, and ease it down on the cradle where Wyoming would twist it around. Montana was to undo the MJ-1 strap so that Cactus Joe could position his horse on the other side, and California was to see that every detail was right. Well, everything went fine. The tools were checked, checklists brought out, test gear positioned, and everything made ready for the Bullpup's arrival. The trailer load of Bullpups arrived in fine shape and the operation began. The first Bullpup was unstrapped from the trailer and the MJ-1 strap secured around it before it was lifted from the trailer. Then Cactus Joe eased the Bullpup up and over to the cradle and gently set it down. Montana unhooked one side of the MJ-1 security strap and signaled Pete to move away. As he did, the security strap on the MJ-1 snagged the Bullpup stand and tipped it over. The fall was too much and the Bullpup plowed into the ramp with a shuddering thud, gasped once, rolled over, and died! The fall had broken the Bullpup's back.

Montana said it wasn't his fault because the Bullpup came off the trailer wrong and had to be shifted. Besides that, it was Wyoming's fault because he didn't make sure the straps were clear before his pony (MJ-1) shifted sides. Wyoming said it was California's fault for not stopping the show in time and then the discussion really got hot and heavy as each man tried to justify his position.

Well, when the judges' flag went down, there stood Desert Pete, Cactus Joe, Montana, Wyoming, and California with a dead Bullpup on their hands and the "Flying Bull" team lost the prize to the precision "Bullpup" team. In addition to possible physical injury, the health of the team members was jeopardized by possible gas leaks out of the Bullpup. The boss was sore about the whole affair because it cost him one of his high-priced "Bulls."

Although these men were not injured, the hazards associated with the Bullpup can be just as deadly to Bullpup handlers as those a novice or careless cowboy could expect in the rodeo contests. Only by flawless knowledge of the task and hardware and by constant alertness during training and actual loadings can Bullpup teams achieve the smooth response, exact performance and precise movements which are so necessary to turn in consistently safe, top notch loadings. ☆



Boy, have I got a splitting headache! I was flying down the coast when, with no warning, some idiot fired this big shell at me. It must have been 100 feet long. It was spewing fire from the tail and my ears still ring from the thunder it made. I did a violent 90 and it missed, but it like to of scared me to death.

Now, the only reason I can see for shooting at me is that men seem to think we birds are always trying to fly into their airplanes. I've seen some of their reports — broken windshields, dented wings, torn up engine turbines, smashed landing lights . . . and they're all written like it was our fault. Ever stop to think what happens to us birds? Zap—a dab of guts and feathers, that's all. Brrrr, if that thing had hit me this morning.

It ain't fair, really. A bird hatches, eats things, grows, flies around, drops things, eventually he dies. No problem to anybody, really. But you men have got to keep bothering us. You have burned rubber tires near our roosting places, you have fired cannons to try to scare us away, you have cut down some excellent roosting trees near airbases and drained some of our favorite swamps. I can just hear someone saying, "Look at that crazy scrambling pelican," when that building-sized bullet missed me this morning.

So . . . o . . . o while I soak my singed feathers, how about a truce? Interested? Maybe we can get a little accommodation going here. Let's look at some advantages from your point of view. After all, we do outnumber you and even though we get killed (means the same thing as fatally injured) you usually have some expensive repair work, may lose an aircraft and occasionally some people.

Let's look at a few examples:

One of your T-38's flew through a flock of us and sucked one of my cousins into the intake of one engine. This ruined the engine and my cousin. One of your people suggested that all pilots fly with visors down (maybe we show up better Polaroid) and noted that it is possible to ingest birds in both engines simultaneously.

One of your '105's met a large bird nose to nose. Part of the bird ripped a 12-inch hole in the radome and the remainder went into the left engine intake.

While flying almost due east a B-58 completely disrupted an orderly formation of ducks and swallowed one in the No. 4 engine. Goodbye duck, of course, but he raised hob going through the grinding wheels and you had to dump 35,000 pounds of smelly kerosene to get down to landing weight.

Just heard that one of my near-sighted kin became involved with the oversized blades of a helicopter. Slicing was successful—my kin became next-of and the helo operator filled out an OHR.

One of your F-105 troops reported that, on his third low level, high speed run a big bird, believed to be a duck, struck the aircraft just to the right of the windshield. Ridiculous. The legalized buzzer of yours struck the duck. Believe me, we get out of the way when we can. But in the last few years you've taken to sending high altitude bombers screaming along just above the tree tops and some of your fighters through faster than their sound can travel. Still, you have the gall to say the duck hit the '105. Whale feathers.

One night you were blasting one of your eight-engine jobs along just above the tree tops, probably just so's you could scare us out of our

WE WERE HERE FIRST!

By A. Bird

wits. Pow, you hit and killed one of my fellows with the right windshield. A little later and, pow again, you killed one with the left windshield. You guys were lucky. Sometimes the glass breaks and it is possible, especially if you plow through a whole flock of us feathered types, to lose one of your airplanes.

There are many more examples, all point up the fact that we *both* lose in bird-aircraft encounters. Let's cooperate and minimalize (this word stolen from the military) this mutual hazard. But we must be realistic about it. I've studied some of your propositions and a few are downright silly. For example, "... that every pilot, regardless of type aircraft being flown, make a supreme effort to avoid collision with birds and other small objects during flight, commensurate with air safety and discipline." This may mean something, but not to an ordinary bird like me.

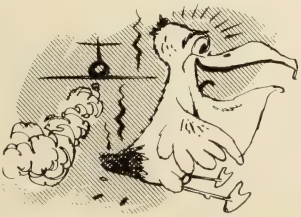
Here are some suggestions:

Don't fly at dawn and dusk. As soon as it is light enough we like to start searching for chow and as darkness approaches we beat it back to favorite roosting spots.

Fly up high whenever you can. We have to flap hard and breathe deeper the higher we go so most of us stick close to the ground.

When you have to fly at low level, go where we aren't. If you insist on practicing landings at a coastal base just when the herring are running good you've got to expect gulls and other friends of mine will be there in force also.

Use your radar to watch for us. We like to fly formation too, and you've finally learned that what you thought were "noise" or "angels" are really us birds. Here's where that accommodation bit can work. If you see we are coming down the east side of the field, have your aircraft fly on the west side. They can turn one direction as well as another. Sometimes, too, those fellows you have in glass towers should be able to see us and can direct aircraft the other way. Unfortunately, we have no way of knowing which direction one of your planes will go next or, I can assure you, we would get out of the way.



It's none of my business really, but collision potential is proportionate to exposure. If you'd come right in and land, not spiral down from way above the clouds, not circle around like a dog does before he finally decides to lie down, well, this would help.

If you want to fool around with shooting of guns, racing up and down in cars, blowing horns, installing artificial distress calls, burning those stinking rubber tires, go ahead. If the fishing is just as good somewhere else we will probably move. If it isn't, we will most likely put up with such nuisances. You can shoot us (I suggest you use something smaller and faster starting than you tried on me this morning), but we have your Audubon Society and our natural reproductive instincts on our side.

Move your garbage dumps away from airfields. This doesn't affect me, but a few of my poor relations will eat anything.

Go ahead and spray your trees and our roosting areas near your airfields. Most of us will move, but if our survivability goes up we don't mind.

Slow down. The farther away we can hear and see you, the more time we have to get out of the way.

Try and avoid our airways. Many of my relatives have migratory routes, particularly along coasts, and in the fall we generally fly south when we have a tailwind, and in the spring north with a tailwind. So . . . o . . . o, watch out.

Now how about a little cooperation. We are doing our part to try for coexistence. This is more than fair, I figure. After all, we were here first. ☆

Why Investigate?

By Capt Charles G. Russell, Hq Air Proving Ground Center, Eglin Air Force Base, Florida

It was Monday, the 27th, just nine days since the accident. A pencil, rapping on the conference room table, indicated the business at hand was about to begin. Colonel Wagner, seated at the head of the U-shaped group of tables, cleared his throat in that peculiar way of his when he wanted immediate silence in the room.

"Gentlemen, the board will come to order. Let the minutes reflect that all of those board members present at this meeting were also present at all other meetings; and you are again reminded that the purpose of this board of officers is to investigate the major aircraft accident which occurred here on the 18th."

The Colonel glanced at the papers in front of him and continued, "We have interviewed the witnesses, taken the necessary statements and accumulated the data we thought we needed. A copy of each document has been placed in the folder located on the table in front of you. Our problem is this: Even with all of this data we have been unable to determine a primary cause for this accident."

Colonel Wagner paused to light his pipe and concluded, "Because of this, I feel we must back up and take a fresh look at the whole situation. I suggest a review of the entire accident from the beginning. What do you think?"

Heads nodded reluctantly and a weak "Yes sir" was heard from the back of the room.

"Major Roberts," the board president said, since you're the investigator, perhaps you had better start the review."

"Yes sir," Major Roberts said, as he slowly opened the folder in front of him. Here we go again, he thought to himself. This doggone investigation is going to run on forever. Why, I haven't even had a chance to fly since the miserable thing started. I still say the cause is obvious, the airplane was just stalled in on the final turn.

Major Roberts spoke out loud now, letting the boredom creep into his voice a little more than he intended. He identified the pilots, then picked up the History of Flight and began reading the details of the preflight, engine start, taxi, and takeoff. For the sake of brevity, he reduced some paragraphs to shorter sentences of his own, " . . . and everything was normal about the flight up until the time of landing. Ground witnesses testified the T-33 pitched out in a normal manner and rolled out on downwind at the usual place. The Mobile Control Officer observed the gear extension at this time, and all three gears appeared to be down and locked prior to the base turn. He couldn't be sure if the flaps were also lowered then, but probably were since they were fully extended at the crash site.

"The turn to base also appeared normal to both Mobile Control and other ground witnesses. About halfway through the final turn, which was later classified as a little low—about 400 feet above ground level—the aircraft bank attitude increased momentarily from an estimated 45 degrees to 80 degrees. At this time, the nose went down sharply to about 60 degrees below the horizon, and the aircraft continued to go down until it struck the ground one-half mile short of the runway. The aircraft was completely destroyed and both pilots were killed. Fuel on board at the time of the accident was estimated to be between 200 and 250 gallons."

Roberts placed the History of Flight back in the folder and withdrew the partially completed Investigation and Analysis. "We discovered that the engine was running at approximately 50 to 60 per cent RPM at time of impact, and a breakdown of the engine failed to reveal any inflight problems. As everyone knows, we concentrated on examination of the flight controls, but we didn't get anywhere there either. All of the remaining components, which included the most important ones, checked out okay."

Captain Sanders, the pilot member of the board, interrupted at this point. "What about the possibility of runaway trim, sir? Have we definitely ruled that out as a possible cause?"

Major Roberts looked at the Captain sharply and spoke as he might to a naughty child, "Sanders, you know that everything in the trim system was all right. We checked those parts that Saturday we had to work all day." He emphasized the word "Saturday."

Colonel Wagner looked up, disapprovingly, but said nothing. He turned to Dr. Rock. "Doc," he said, "as Flight Surgeon in this case, do you still think incapacitation of either pilot was not very probable?"

"Yes, I do, Colonel," the doctor answered. "The medical records didn't indicate any prior physical or emotional problems with either man; and examination of the remains did not indicate a heart problem. The oxygen system checked out good, too. Of course, tissue samples were sent to San Antonio for analysis; but I don't anticipate a positive finding."

"Thanks, Doc, I think that covers the medical situation all right; however, we must be sure to check thoroughly all personal equipment items for our report."

Colonel Wagner then returned his attention to Major Roberts. "Well, Major, that seems to bring us right back to where we were during our last meeting."

"Yes, sir, it does," the investigator answered. "I still can't help but think that we're trying to make something complicated out of something simple. Let's face it; the jocks just sucked the bird around the final turn because of that 15 knot crosswind, and stalled out. That's all there is to it. With all due respect to the board, Colonel, I think we've just been spinning our wheels."

Colonel Wagner allowed the silence to settle around the room for a full 30 seconds after the investigator finished speaking. At last he spoke, his voice serious, "Gentlemen, it's apparent that some of you fail to fully realize your obligation as a member of an accident investigation board. I am sure you want to carry out your duties, but we must never sacrifice thoroughness for speed. I want to set the record straight right here and now. Any aircraft accident is serious business, no matter what type plane is involved — and it's doubly serious when there are associated fatalities. The cost to the government for this accident is $123,000 for the T-33, approximately $200,000 in survivor benefits for the pilots' families, and another $50,000 for the cost of this investigation. This totals $373,000 and doesn't even reflect the tremendous cost of training replacements for those pilots."

The president cleared his throat again while he let the impact of what he had said sink in. He continued, "Now multiply this figure by 360, the number of days in a year, because that approximates the annual number of USAF accidents—and mentally throw in a few expensive B-52's, F-105's, etc., that are a part of the total—and the cost comes to roughly $1,300,000 per day. This, in itself, is ample reason for a thorough investigation; but the most important aspect of the whole business is accident prevention. If we didn't find the real cause of accidents and apply that knowledge to prevent other accidents, we would soon be losing airplanes faster than the manufacturers could make them—and pilots would take a dim view of their life expectancy to boot. This is why I must require a complete investigation of this accident. Before we decide that two very experienced pilots stalled the bird while turning on final, we are obligated to thoroughly exhaust every possibility. Our assessment of the cause factor must be substantiated by factual, accurate and fully documented data. We must present a complete picture to the reviewing authorities." The Colonel paused, looked directly at Major Roberts, and concluded, "Do I make myself clear, gentlemen?"

The maintenance officer, Major Smith, half raised his hand at this point and said, "Sir, since it's getting late in the day, I'd like to be excused so that I can re-examine the wreckage in relation to the T.O. compliances. There are a couple of items I'm not sure of yet."

"Good idea, Jim," the Colonel answered, "and Sanders, I'd like to be a little more familiar with the flying habits of the pilots. Will you and Major Roberts look into that, please? And Doctor Rock, let's you and I go down and look over the cockpit area again. The meeting is hereby adjourned until 0800 tomorrow morning."

The next morning was dark, rainy, and cold; but as the accident board members filed into the room, Colonel Wagner wore a cheerful expression on his face. He opened the meeting and said, "Major Smith and I found something yesterday that might well be the cause of the accident. Now, we can't be sure yet, but it has definite possibilities. Jim will you give the board a rundown on what we discussed?"

"I'll be glad to, sir," the mainte-

nance officer said as he shuffled some papers in front of him. "I don't know why in the world we didn't notice before, but the pilot seat separator was actuated in the front cockpit, while the one in the rear seat was not. We thought that this most likely occurred during impact, but after closer examination we found that the roller bar was bent down tightly on the strap after the take-up reel had completely actuated. To further substantiate this theory, we discovered that the initiator that actuates the lap belt and seat separator in the front seat had fired, while the rear seat was still live when EOD reached the scene. A check of the aircraft record showed us that T.O. 1T-33A-615, which is the one for installation of man/seat separator in conjunction with the rocket seat, had been completed at IRAN the week before and that this was the first flight since the aircraft returned."

"To be sure we are on the right track," Colonel Wagner explained, "the Wing Commander gave an order last night to ground all T-33's that have the separator installed until a one-time inspection can be made of the system. We will be notified of the results as soon as they are completed, so in the meantime, let's think about this logically and see if we can find any other data to substantiate this theory."

Captain Sanders spoke up immediately, "This may not mean anything, Colonel, but I've flown with the pilot perhaps more than most pilots on base and I've noticed that he had a habit of raising the seat all the way up on base leg. I remember I asked him about it one day when we were shooting landings because I could hear the seat actuate each time we approached the runway. He told me that since he was a little short he preferred to have the seat all the way up for landing, but liked it about halfway up for other phases of flight. Also, to further reduce the possibility of accidentally stalling on final, the stanboard pilot told me last night that the pilot was used to flying century series aircraft prior to coming here, and that his traffic patterns were always wide with plenty of airspeed. Power was never reduced below 60 per cent until after crossing the fence. In addition, he had stated on several occasions that he didn't believe in performing power off patterns which, as we all know, some T-Bird pilots still do occasionally in spite of what is in the Dash One."

Major Roberts spoke up at this point, "Colonel, prior to today we—I especially—placed a lot of emphasis on the crosswind. Before coming to the meeting this morning I listened to the tower tape again, and I now think it's significant to note that the pilot asked about the winds twice prior to his pitch. I now feel certain in my own mind that since he was concerned about the wind we should assume—in the absence of any information to the contrary—that he compensated for it in the proper manner. In addition, I think we can safely conclude that the pilot was in control of the aircraft at the time since it was he who made the radio transmissions, and the copilot would not be allowed to land from the rear because he was not an IP. As you recall, the pilot was a stickler for regulations."

At this point the Colonel was called from the room. Five minutes later he again faced the group. "That call was from Quality Control. An inspection of the T-Birds revealed that the seat/man separator T.O. called for an unprotected cable to be run along the rear left of the seat. This cable extracts the seat pin from the lap belt and seat /man separator as the seat leaves the aircraft. They said that it was quite possible for the cable, due to its position, to become loose enough to catch in the lap belt when the pilot straps in and be pulled when the seat is raised. It appears now, that such was the case in this accident, and that when the pilot raised the seat the initiator was accidentally fired. This automatically opened the lap belt and actuated the seat separator, forcing him into the instrument panel and control stick. There was not sufficient altitude remaining for him to recover before striking the ground. If every one agrees, our immediate action will be to notify Headquarters USAF, Directorate of Aerospace Safety and the AMA concerned recommending a redesign of the seat separator installation."

As the Colonel paused briefly to light his pipe, he could see a glow in the faces of the men that comes from realizing that one has accomplished something worthwhile. He blew out his match and continued, "Before we break for lunch, I'd like to say that I know this has been a lengthy investigation and that it has required that you be away from your normal duties for a long time; but had we been satisfied with our first analysis and not pressed to investigate all of the facts, we may very well have been the indirect cause of other accidents and fatalities. As it turned out, we can be proud of our efforts and each of us can know that because we did demand a complete investigation we have fulfilled our purpose in preserving the combat potential of the Air Force."

As the board members filed out of the room each man was smiling, but perhaps the biggest smile was on the face of Major Roberts, because his haste had brought him the closest to making a disastrous mistake—but the mistake hadn't been made. ☆

Missilanea

PHASEDOWN PROFESSIONALISM—With the accelerated phasedown program for our ICBMs being implemented on relatively short notice, the display of professionalism by all agencies is noteworthy. Those Strategic Missile Squadrons affected are: 567 SMS, Fairchild AFB; 577 SMS, Altus AFB; 578 SMS, Dyess AFB; 569 SMS, Walker AFB; 851 SMS, Beale AFB; 850 SMS, Ellsworth AFB; 568 SMS, Larson AFB; 569 SMS, Mt. Home AFB; and 451 SMW, Lowry AFB. All are deserving of special recognition!

Personnel from the Missile Safety Division, Directorate of Aerospace Safety, have visited several of these units during phasedown and reported favorably upon all activities observed. After receiving the executive order for deactivation of selected units, and working with only broad guidelines, each missile organization concerned has developed and executed a comprehensive phasedown plan.

Emphasis on safety must be paramount during any operation of this magnitude, regardless of the disposition of equipment being removed. For the preservation and maintainability of potential combat capabilities, highly skilled and trained personnel involved in this task must not be unduly exposed to hazards.

Lt Col A. C. Eggleston
Directorate of Aerospace Safety

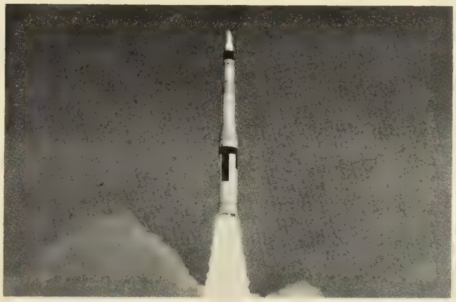
CROSS CHECK—How many words have been written about technical data? How many conferences have been held to re-write technical data? How many hours have been spent validating technical data? How many AFTO Forms 22 have been submitted on technical data changes? How is it, then, that potentially serious inconsistencies in technical data can exist throughout the life span of a weapon system and not be discovered until the phaseout cycle?

Case in point: A weapon system using different series missiles in different configurations utilized a common piece of ordnance. Yet, technical data for one model called for this piece of ordnance to have a shorting plug installed prior to shipment, and technical data for another series called for the same piece of ordnance to be removed and placed in a separate container prior to shipment.

If this ordnance is hazardous enough to require its removal from one series, then why isn't it hazardous enough to require its removal from another series of the same missile?

It is recognized that the troops using technical data for one series would not necessarily be familiar with technical data for another series. When like weapon systems, but different series are used, it might be wise to screen for discrepancies. This would be applicable in aircraft as well as in the missile field.

Lt Col C. N. Mozley
Directorate of Aerospace Safety



GUIDANCE AND CONTROL COOLANT CONTAMINATION—Sodium chromate coolant was found to be leaking from a Minuteman missile guidance set during unscheduled maintenance in the Launch Facility. The Guidance and Control set was removed and replaced. Due to a faulty connection, some leaking occurred around the G&C umbilical head interface. Four mating and demating operations of the umbilical were accomplished before a good connection was assured and no further exterior leaking was observed. The following day the G&C set was removed to permit a downstage test to be performed; approximately one-half cup of coolant was discovered at the top of the third stage rocket motor, inside the raceway cover and around the jamb-nut (B-nut) inside the G&C container. No exterior leaks were found either at the umbilical interface or anywhere else on the missile.

OOAMA has established a materiel improvement project to evaluate the problem. T. O. 11G2-10-5-3 gives the procedures for installing the flexible coolant hose assembly.

Major R. L. Mahynske
Directorate of Aerospace Safety

♂MAN

Accidents, basically, are caused by only two factors, people and things. The simplest kind, as has been repeatedly demonstrated, usually involve things. Things can often be modified to the point that their reliability becomes extremely high. When man is considered, however, it has become popular to indulge in long erudite discussions of the fact that he was the same, is the same, and will remain the same and that his inherent failings are such that no real hope exists for either explaining or decreasing his contribution to accidents.

THE MAN AND THE MACHINE

The entire field of human engineering has grown from the recognized fact that, in addition to basic functional reliability, the machine's operation must be compatible with man's ability. Aircraft cockpit designs have developed through both logic and trial and error to the point that many of man's frailties have been specifically considered in the design of the equipment. It is agreed that controls must be within reach, instruments visible, presentations meaningful, and known incompatible inter-relations between instruments and controls avoided. The fact that man's span of attention is limited is recognized and its parameters reasonably well documented. In the light of this known information, if a cockpit should be designed which contains 114 warning lights, it can only be said that the designers are inviting accidents for there is no evidence to indicate that man was ever capable of adequately monitoring such a number. If painfully developed knowledge is flagrantly disregarded certainly accidents must increase.

THE MAN IN AN ENVIRONMENT

The man and the machine, either separately or as a unit, operate in some environmental setting. This setting always involves two features, one of which is location and the other is time.

The fact that man operates in time is one of his most important limiting factors. This is brought most forcibly into focus in the area of see and be seen flying. Space can be covered so rapidly in high performance aircraft that by the time an on-coming collision object can be physically seen it is too late to initiate the actions required for its avoidance.

Some years ago a simple, unpublished experiment was conducted in which a slow moving C-47 was used to avoid a collision with a vertical light beam from a theodolite. The pilot who was to avoid the collision was given control of the aircraft at various known distances from the beam. The unequivocal findings, of great surprise to both of the experienced Air Force pilots involved, was that a mimimum of nine seconds was required for successful avoidance even with the ideal conditions under which the experiment was conducted. When high performance aircraft are converging at rates well in excess of 1000 miles per hour, this nine seconds means that the avoidance of a midair collision cannot be left up to either pilot.

Midair collisions continue to be experienced. The requirement that a pilot with his limited vision be responsible for enroute avoidance is completely unrealistic. The fact that accidents will continue to occur in this area results not from lack of knowledge but from the failure to accept information which is well known and well documented.

Time as a variable is not always a matter of split seconds. It is documented that the day of the week is a factor in accidents. In aircraft, lower rates are experienced at the beginning of the week with a gradual increase toward the end. Accidents reach a high plateau on weekends with a sharp drop for the beginning of the next week.

Another time variable of importance results from the fact that man has built-in psychophysiological cycles of sleep and wakefulness which cannot be violated with impunity. Disruption of these built-in physiological rhythms which follow the rapid crossing of many time lines creates disruption of rest cycles, fatigue and consequent inefficiency.

Time also plays a factor when an individual is in a hurry to accomplish some often unnecessary end such as getting home at a specified time or a more important one such as getting an aircraft prepared for an operational mission. In either case the attempts to crowd too many activities into too short a time period result in difficulties.

Implicit in most time considerations are space factors. Space as an environmental consideration varies from the often extensive external operating environment of a vehicle to the sometimes highly restricted work space which the operator must occupy in its operation. The hazards of high altitude as an operational environment are well known. The fact that man needs certain terrestrial equivalents is equally well known. Modification of the outside environment makes meeting these requirements more difficult but does not change them.

Not all operational environments are as glamorous

the known factor

By Anchard F. Zeller, Ph.D., Research Psychologist, Asst. for Medical Services, DTIG

as space. The mechanic in the machine shop is surrounded with many hazards, yet his most frequent injuries involve broken toes and strained backs. Individuals exposed to toxic environments certainly need protection, yet the most prevalent difficulties relate to common hydro-carbon compounds rather than the far more toxic materials to which they may be exposed.

In terms of work space itself, it is axiomatic that this should be adequate. Yet, cockpits are designed which make it almost impossible for the individual to operate adequately if he wears the available protective clothing, such as pressure or survival suits, which is required because experience indicates that the machine itself may not be reliable.

These things are known. Also known is a great deal about the man himself.

MAN'S LIMITATIONS

Some of the things about man which have been clearly documented are quite abstract, others much more readily measurable. It is known, for example, that man reacts to rewards and punishments. He finds punishment distasteful, but needs and is encouraged by rewards. He has other abstract needs; the need, for example, for relaxation. This need can lead him into many accident producing situations. When associated with sports activities it increases his potential for accidents, particularly if these involve activities for which he is not prepared.

Man also becomes inefficient from the results of his own activities. Although controversy rages as to what fatigue is and how to measure it, there is certainly no question that it is a very real phenomenon and that common sense rules can result in greater efficiency with less possibility of accidents. The human body is also impaired at times because of illness which produces inefficiency in varying degrees. Sometimes the very medication aimed at restoring the individual to health results in additional impairments which greatly increase the individual's potential for accidents.

Aside from the psychophysiological limitations which can be reasonably well documented, man has a variety of functional limitations. The human visual system does not estimate vertical height nor rate of closure with a great deal of accuracy, yet every landing requires that these estimates be made. The result is that periodically over-shooting, hard landings, or other mishaps occur. Mechanical aids are definitely required in this area. They vary from the simplest which merely require that the individual land with sufficient leeway so as to take his inefficiency into account, to the much more sophisticated coupling systems which may eventually accomplish the landing process with man acting as a monitor.

There are other functional limitations. Some individuals have greater aptitude for some types of activities than others. Greater efforts at defining the function to be performed and selecting the individual to perform it can certainly contribute to improving efficiency and decreasing the number of accidents. Functionally, man does not ordinarily perform well without training. Training cannot be geared to the most competent individual in a class, nor even the average, but must be aimed at the least capable if there is to be any validity in the assumption that the information presented has been learned. Once training is accomplished it is of no value unless employed. An individual trained in one specialty and utilized in another can certainly not be expected to be particularly efficient or safe. Memory is not perfect. In any activity, review is necessary, whether it be the problem of currency in flying, the launching of a missile, or loading munitions. If the activity is not accomplished with sufficient frequency, both the knowledge of how to perform the activity and the skill with which to do it will decrease. Some people can not learn some things, but even if the activity can be learned, the human system cannot be overloaded. A current problem relating to the number of different munitions which an individual can load points up this clearly. Although learning any one of the systems is completely within the capabilities of the individuals concerned, to expect such an individual to remain proficient in loading a great number of different kinds at the same time is completely unrealistic.

Training is ordinarily associated with close supervision. It is also associated with high accident potential. Learning is not accomplished without errors. The most hazardous period, however, often immediately follows the release from training. Pilots in their first operational assignment, released from the supervision of the training command, and expected to fulfill the mission in the manner of an accomplished pilot, face the highest accident potential of their entire flying career. This is the period which demands the greatest attention.

Not only is original learning fraught with accident hazard but so is the transition period. Transitions bring habits into conflict with each other which produces mistakes which cause accidents. With the passage of time rank increases and assignments change. An active pilot may find himself a desk pilot. An active mechanic

MAN (continued)

may find himself a supervisor. People in these categories who attempt to resume their original function will find that inefficiency has crept in. It is easily documented, for example, that desk pilots have a higher accident potential than pilots who fly the mission aircraft regularly.

The Air Force has a system of read and initial for literally mountains of material. The man's initial implies that he has read and understands the material and on the basis of some unheard of ability is expected to remember it. Information is not absorbed in this fashion. As long as safety is based upon blind faith in methods so completely in opposition to known human abilities, accidents will inevitably continue to occur.

In addition to all of man's other limitations, he has emotional disturbances. Although the exact effect of these upon efficiency remains a subject of discussion, there is certainly no doubt that an individual with known emotional disturbances should not be expected to continue in his normal functions, particularly if these involve high risk situations. Every one has a breaking point and although the individual who has been relatively stable is quite likely to remain that way, this cannot be accepted as an operating principle. Even as machines wear out and break, so does the human body and the human mind. There must be a constant surveillance over all people at all times. It should also be accepted that men are much the same whether they are supervisors or workmen. The supervisor must not only recognize the limitations of his men but recognize that these same ones apply to him.

Systems don't just happen. They have to be carefully designed, put in motion, directed and maintained. Very careful supervision of all facets of an activity is required if it is to remain in effect.

What are the implications of this, by no means exhaustive, listing of man's assets and limitations? It is aimed at demonstrating only one point. A great deal is known about the human. There is flagrant disregard for much of what is known. Accidents will continue until these known features are taken into active consideration.

MAN IN THE FUTURE

Regardless of the area considered, it appears that the future will involve no decrease and in all probability an increase in potential for accidents. Fortunately, however, it is the same man about which a tremendous amount is known. If this knowledge is applied, and if additional knowledge is developed, accidents can certainly be prevented. If systems are set up which are in direct conflict with what is known about man's limitations and safe procedures, accidents will surely result. To hold a safety officer responsible for no accidents under such conditions is as unrealistic as directing that no accidents occur. Man has been and must continue to be the focal point of the accident prevention program. If there is a realistic desire to prevent accidents his limitations must be recognized, accepted, and incorporated into the overall plan. If this is done accidents will inevitably be prevented. ☆

WHAT HAPPENED?

By Maj R. G. Clithero, 801 Air Division, Lockbourne AFB, Ohio

The photo inside the front cover shows a wrecked automobile, but it doesn't give any clue as to what happened. The picture here should give you a good idea. However, there's a story behind that blown tire that caused the automobile to leave the highway and roll over at least three times: the owner traded off the original tires for a pittance of cash. But he must have learned something from his experience.

When we arrived at the scene we were informed that the owner, who luckily wasn't hurt, had gone to the hospital for a checkup. But he never showed up at the hospital, and at the police station, home, squadron headquarters, duty section no one knew his whereabouts. Where was he? Turned out the man had reported to the base theater just in time to see and get credit for the mandatory holiday safety movie.

Last year started out pretty well for us. During the first seven months the base had only one military auto death. It was caused by a young man who went to sleep at the wheel after a hard day's night of drinking and driving.

In the last five months of 1964, we experienced or investigated (because they occurred in our area) eight airman private vehicle fatalities. Here are some interesting statistics on these eight fatals.

- The drivers' ages were 18, 20, 20, 20, 21, 21, 27, and 30.
- Five were driving borrowed or unfamiliar autos.
- Five were suffering from the effects of fatigue or drink—or both.
- Five were speeding.
- Five would have survived if they had had seat belts and had used them.
- Three were in violation of pass limits.
- Three were single vehicle accidents.
- All eight died by their own hand through childish, immature acts. ☆

Rex Riley's CROSS COUNTRY NOTES

HISTORY REPEATS—"On downwind he (the pilot) noticed the nose gear light was out. He made a low go, and mobile reported gear appeared to be okay. The pilot then changed the bulb but the light was still out. Then the aircraft flamed out and could not be restarted. After steering the machine away from a farm house, the pilot successfully ejected—at 350-400 feet. It was determined that he inadvertently turned off the master switch with the side of his hand while changing the light bulb. The switch protrudes 1/8 inch beyond the guard . . ." The above is quoted from AEROSPACE SAFETY Magazine, February, 1962.

Same song, second verse: The following is extracted from the investigation of an accident that occurred in September, 1964: ". . . Primary cause is pilot factor in that pilot inadvertently and unknowingly activated engine master switch to OFF position, resulting in fuel starvation and flameout. (Engine master switch controls main fuel shutoff valve.)

". . . Master switch is not adequately guarded and protrudes 3/16 inch beyond present semi-guard."

This accident occurred on final approach and the pilot was in the process of changing the landing gear warning bulb. Fortunately, even though at low altitude, he managed to eject successfully.

SERMON TOPICS. A couple of old, old, old subjects, always good for another sermon, are merely going to be mentioned this time—Rex can't think of any new way of putting the words together. First one: gear up landings. A century series jock scraped to a halt on a 10,000 foot southwestern strip. Visibility was 60 miles. Cause of accident: pilot forgot the gear.

Second subject: access doors. About two minutes after takeoff the refrigerator compartment access door came off, struck the vertical stabilizer and caused minor damage. In another case flight was normal until the second firing pass when a thud was heard and a fluttering vibration was felt. When something flashed past the left side the fluttering ceased. The mission was aborted, armament switches safetied and, when fuel was burned down, an uneventful landing was made. All sorts of fixes have been proposed for such incidents as this, but it should be remembered that there is no problem if work is proper and complete and preflight inspections are diligently accomplished.

DISRUPTIONS, DISRUPTIONS. When Uncle Sam bought the Air Force CH-3C's Rex shook his head and predicted it would just be a matter of time. Here's how it happened. The two pilots had been out for over two hours, doing local transition and instrument work. Returning to base for termination landing the IP cut an engine on downwind for a simulated single engine approach and landing (disruption No. 1).

On the turn to base the pilot asked the tower if Ops wanted them to shutdown after returning to the ramp. Tower advised, "Stand by." (Disruption No. 2, or 2 plus.)

Pre-landing checklist was then started, but interrupted when the tower called with a traffic advisory and to relay information previously requested. (More disruptions.)

WHAT GEAR?
GEAR!

The pilot acknowledged the advisory and reported gear down. He was cleared to land. Approximately one foot from touchdown the tower called and advised the gear was not down. Max power on the "good" engine and immediate addition of power to the simulated failed engine didn't quite hack it. The anti-collision light lens was broken and the bottom of the bird slightly scraped.

Habit pattern interference r'ared its ugly head again, plus the fact that helicopter pilots have long been used to not having to lower gear. Besides, they have no gear-up warning devices as on conventional aircraft. And you guys in the tower—holler at 'em a little sooner, please. ☆

Can A Tiger Change Its Stripes?

By Bob Harrison

Squirming awkwardly in her chair, the pert blonde secretary futilely tried to stretch over her knees a skirt that was designed for the very opposite purpose.

"Read that last sentence back," said Captain C. Z. Chumley.

"Yes, sir. Let me see . . . 'Furthermore, we will no longer tolerate these late shipments. We will . . uh, uh, have . . uh . . to take action if this . . . uh . . continues. Our aircraft belong in the . . uh . . sky . . not on the . . uh . . ramp and without these parts . . uh . .' That's as far as we got, sir."

"Well, just add, 'we can't keep them there, so please look into this matter immediately. Sincerely, etc., etc.' Now, if you'll get the morning mail, Miss Schaep, we'll see what's to be done this afternoon."

A few moments later the girl returned with a fat bundle of papers and envelopes which she deposited in the IN basket on Chumley's desk. Most of the material went into the waste paper can but one item made him pause. He read, "Capt. C. Z. Chumley, etc. Congratulations on attaining another anniversary. It is my pleasure to notify you that you are scheduled to attend instrument refresher school beginning next Monday, the 16th. If this date is not convenient, please feel free to contact me. I should point out that the commander is concerned with the proficiency of all pilots on this base, particularly in view of the limited number of available flying hours. He is determined that pilot proficiency will not suffer and that training schedules will be adhered to in all cases." The message was signed by the operations officer.

Grumbling about having to cancel a trip he had planned for the following week, Chumley dialed and got the training chief on the phone. "Jack, this is Captain Chumley, would it be convenient to juggle your schedule a bit and put me in school beginning the 23rd instead of next week?"

"Sure thing, Chum, except that the old man must approve each request for rescheduling. Just get that and send it along and I'll set you up for any time you like."

"Well, thanks, Jack, see you Monday."

On Monday morning Chumley sauntered into instrument class somewhat past the hour. The instructor was discussing holding procedures. Chumley was amazed at the number of brother pilots in attendance; only one vacant seat was apparent.

"Good morning, Captain Chumley. Here's your kit, please take a seat."

As Chumley settled into the chair he glanced around to see who was in the room. The commander himself and several other older Air Force types sporting eagles on their shoulders were in attendance.

"Now, assume you are told to hold west of Dipstick intersection at 21,000 feet in a C-130. What would be your maximum permissible airspeed and length of the legs in the pattern? How about you, Captain Chumley? Can you answer this?"

"Why that's simple. Hold at 180 knots indicated and one-minute legs." Ask me a hard one, Chum thought to himself, thinking this a good opportunity to make impressions.

"Sorry, Captain, you're thinking of *below* 14,000 feet. But you were incorrect even there. The correct answer is 175 knots indicated and one and one-half minute legs. Better brush up on that before the examination."

Chumley considered arguing, decided against it and pulled himself up into what he considered to be an alert, eager, sitting position. The next question that came his way he fielded deftly, but there were two more during the morning he could not answer. By the end of the morning session he was tired, frustrated and feeling a little foolish. "That dern instructor was determined to make a fool out of me. Oh, well that's the way some people get their kicks."

That afternoon he was scheduled in the simulator, but there too he ran into trouble, this time with a different instructor. Climbing out of the machine, he quipped: "Well, here I am in New Awluns. Which way to the Mardi Gras, friend?"

The instructor didn't see anything funny in the remark and decided he'd take the ebullient Chumley down a bit. "Captain, I don't doubt that you think you're in New Orleans, but you are still here at good old Weedpatch. Take a look at this tracing. You were supposed to fly from here to Dipstick intersection, arriving there at 15,000, then climbing to 30,000 at Cowlick. Your cruise altitude was 34,000 at Candlestick, then a penetration and over the outer marker at 8000 descending to 2500 passing the middle marker for a landing at Emory AFB.

"You were off on your times, heading and altitude. You arrived at Dipstick on time but at 14,000, not 15,000. At Cowlick you were 1500 feet high and two minutes late. Where were you, sightseeing over the Grand Canyon? Then instead of 34,000 feet, you varied from 32,900 to nearly a thousand feet above your assigned altitude. Then at Emory you were at 10,000 over the outer marker. How you made it to the middle marker at the right altitude I'll never know, but they say miracles can happen.

"Now, what if you were really flying that route. Throw in a little weather and an instrument approach at minimums. How do you think you would have made out?"

Chumley squirmed and reddened. For once his bravado was gone. He had to admit the instructor had something. How *would* he have done in weather? What would happen the next time he caught one of these tough ones—lousy weather, MOCP, have to get there?

Back at his office, Chumley breezed by Miss Schaep's desk and closed his door. A moment later he stuck his head out, "I don't want to be bothered the rest of the afternoon—something very important to do and I don't want to be bothered."

Once when the girl opened the door to ask a question she noticed that her boss was reading a manual of some kind.

That night Chumley lugged the manual home with him. His spouse wondered why the diligent reading and frequent note taking. She suspected her frantic breadwinner was in some kind of jam, but past experience had taught her this was no time to offer wifely solace. He stayed up far after she had gone to bed. The next morning he wasn't his usual brash self and left the house half an hour earlier than usual.

This was a different day . . . and a different Chumley. He volunteered to answer questions, and he knew the answers. That afternoon in the simulator he made very few mistakes, and only minor ones at that. The instructor was amazed.

"What happened to you, Captain? Yesterday you were flopping around all over the place; today you're right on the money. Guess you must have gotten over your hangover."

"Well now, let me tell you about it," Chumley replied. "I just decided to have a little fun with you guys. Of course, I fly an airplane like I flew your tethered torture chamber today. Yesterday I was just checking you to see how alert you were. Actually, ol' Chumley can fly one of these things with his hands in his pockets, one eye closed and legs crossed. Tell you what, I'm going to start dropping in on you guys every week or two for a couple of hours in the old box just to make sure you keep on your toes. Ta, ta."

Later in the week his flight check pilot was amazed at the thoroughness Chumley showed in preflighting the aircraft. This was no tire kicking, skin tapping inspection. Every item was carefully checked. Several times he spoke briefly to the crew chief about various items. The IP couldn't believe what he saw. This couldn't be Chumley. He'd ridden with him before and well knew his reputation.

During the flight the IP seldom had to utter a word. The flying was superb, technique flawless, planning and judgment nearly perfect. *What* had happened to Chumley?

Soon the word got around. Pilots all over the base shook their heads in wonderment. Where they previously marveled that Chumley managed to stay on flying status, much less alive, they now wondered what miracle had been wrought. They had been in the habit of carefully checking every aircraft they knew had been flown by Chumley on his previous flight. Now those airplanes were clean, any discrepancies were carefully noted, in detail. OHRs signed by Chumley began to clog the mail channels. He even visited the tower for a brief time and congratulated the personnel there for their fine work. He began to attend flying safety meetings without escort and usually had a comment or two to make.

Heavy lunches at the club gave way to a can of Metrecal at his desk. The evening round of martinis was replaced by a single beer.

Such radical change finally reached all the way to headquarters and the commander began to wonder. Finally he could stand it no longer and called his newly hatched paragon into the office.

"Chumley, I don't know what happened. I don't want to know. In fact, my instinct tells me I had better not even try to find out. I just want to say that your behavior lately is amazing nearly everyone on the base and to me is a matter of great satisfaction. After all those lectures I gave you, finally one took hold. Against my better judgment I'm going to ask which one it was. I may want to use it again."

"I don't know exactly what you are talking about, sir. Lectures? Behavior?"

"Captain Chumley, you haven't goofed in two months. You fly by the book. You haven't frightened any other pilots or control tower people, or the AO for weeks. You frequently spend an hour in the simulator. You have changed, man."

Chumley thought for a moment. Then, "Well, sir, it's this way. I've been writing a book and I'm playing a role. After all you can't just imagine how someone else is. You have to *be* him. Thank goodness, that book is almost finished. As a matter of fact, I think I can wind it up this afternoon. Would you care to stop by the club for a few martinis?"

The colonel declined, dismissed Chumley, and for several minutes sat in deep thought. Finally he muttered, half aloud, "Well, at least I won't be in doubt from now on — and can count on more headaches from Chumley." ☆

Aerobits

LIGHTNING STRIKE—There's been a lot of talk about lightning during the past year or so. Here is another report: A C-130 transporting a crew and chopper to an aircraft crash site was struck on the radome. There was a subsequent explosion in the left pylon which began to burn and continued until shortly before landing. After the aircraft was on the ground, inspection revealed a six-to eight-inch hole in the radome, radar antenna damage, and the pylon damaged beyond repair.

HOW ARE YOUR SUNGLASSES? Credit the airlines for pointing up a hazard that design-changes in sunglasses have produced.

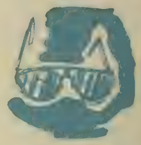
A pilot is highly dependent upon his peripheral vision to acquaint him with the presence of others in air space. If the pilot wears corrective lenses in the form of spectacles or if he wears sunglasses, the frames of either of which block out his peripheral vision, he is depriving himself of nature's radar, his physiological early warning system.

Many of the styles of today's sunglasses have either taken on a certain wrap-around effect or employ the use of extra wide temple pieces that become, in effect, blinders . . . and THAT'S the hazard.

One airline already has added a paragraph to its Flight Manual, prohibiting pilots in flight wearing sunglasses or spectacles having wide, nontransparent or vision-restricting temple pieces.

Are you a stylish hazard, or a good "old fashioned" see-it-all?

FSF Safety Bulletin 64-206



THE SUPREME SACRIFICE—For the little mountain town on the cross-country highway it had been a normal winter day. Snow had been falling, and it continued on into the evening. Wind swirled the snow into a ground blizzard. The curve at the outskirts of town had become quite treacherous. The road was icy. Several local officials, familiar with the road, had skidded into the west-bound lane while rounding the curve—and they were driving at reduced speeds. Had there been traffic westbound, they knew they wouldn't have been able to avoid a collision.

Early that morning an airman had signed out PCS at an Air Force base 900 miles away and headed toward this curve. His intended destination was on east. To reach the curve on the edge of the mountain town shortly before midnight he had averaged 53 miles per hour for 17 hours. He was alone. According to investigators he was traveling about 50 miles per hour coming into the curve. He didn't have a chance at such speed. He lost control, skidded into the west bound lane and collided head-on with a semi-trailer creeping along 18 to 20 miles per hour, due to road and weather conditions. The front wheels were knocked off the truck in the impact; it went off the road and turned over. The airman's car was demolished. Death was instantaneous.

(*Ed. Note*: *PCS travel, TPA authorized, is predicated on* 275 *miles per day. This airman had crowded more than three days driving into* 17 *hours.*)

IT WENT THATAWAY—We will agree that an airfield at night can be very confusing, more so when it is a strange field. The following incident involved a T-33, with two pilots aboard.

On a predawn departure, the pilot taxied to the south end of runway 32. At the end of this runway there is a large paved area with four taxiways intersecting the runway. As the pilot approached takeoff position, he had the runway clearly in sight. Upon reaching the runway, he turned left and proceeded toward the approach end in order to use all available pavement. Entering the five-way intersection, he observed an object in the darkness which he thought to be the MA-1A webbing. What he observed was actually a row of flags which were in place to indicate that this taxiway was closed. The pilot maneuvered toward the flags, lost sight of the runway lights, and aligned himself with the unlighted taxiway, assuming this to be the runway. He was positioned at the end of runway 32 and in the darkness it was not possible for the tower operator to determine that he was not properly oriented. After rolling approximately 1000 feet, the pilot realized that he was not on a runway. He initiated an abort, but was unable to stop on the remaining pavement. The aircraft passed through a floodlight installation and barricade, crossed 50 feet of soft sod and stopped on a gravel road.

Fortunately, this turned out to be a lucky day for these pilots and the Air Force; there was only minor damage to the aircraft. It does not tax the imagination to picture the catastrophic results that could have been, due to the elimination of one simple cross-check—COMPASS HEADING VERSUS RUNWAY HEADING.

Major S. R. Smith
Directorate of Aerospace Safety

B-66 TAKEOFF HAZARD. Arresting gear can be very useful for stopping an aircraft, but when it's engaged while the aircraft is taking off—well, that's another story.

On takeoff the tail skid on a B-66 engaged a Navy abort arresting gear. Fortunately, the skid is not stressed for stopping purposes. It pulled loose, causing scratches and dents in the dragchute doors and chaff dispensing tail cone and a couple of small holes in the tail cone radome.

Takeoff was on a runway with a .59 per cent slope. The aircraft climbed but the runway climbed faster. The pilot and crewmembers said the liftoff looked and felt normal. The tower officer stated that the entire takeoff appeared normal. The most probable cause of this mishap was that the aircraft settled or failed to climb after liftoff from a still-rising upslope runway.

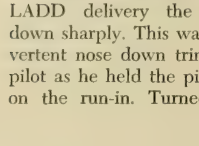
Under the right circumstances, this hazard could apply to many aircraft, particularly those with steep lift-off attitudes. Pilots must be aware of all obstacles to takeoff, and performance of both the pilot and the aircraft must be equal to the situation.

Lt Col Eugene J. Budnik
Directorate of Aerospace Safety

BAGS AWAY! While cruising at 35,000 on a cross-country from Tyndall to England the armament rotary door on an F-101 inadvertently rotated to the primary side, then closed. In the process the crew's luggage—one B-4 bag and one plastic suit bag—were dropped. These "soft bombs" had been hung on the primary side of the door. Armament panel configuration at the time was: arms switch, safe; arm selector, viz ident; ejector racks, locked. The pilot notified Atlanta Center of the incident and continued to destination for RON. Post flight investigation failed to reveal the cause of the malfunction. Door creep from a hydraulic defect hadn't occurred and radar personnel were unable to produce an inadvertent fire signal. Civil authorities have been asked to be on the lookout for two bags.

Aerobits

WEBBED FINGERS—As the pilot of an F-100D began pull-up during a LADD delivery the aircraft pitched down sharply. This was caused by inadvertent nose down trim induced by the pilot as he held the pickle button down on the run-in. Turned out the pilot's gloves were too small for him and a web was formed between his right index finger and right thumb. This web forced the trim button to the nose-down position. Of course the pilot didn't notice this until he moved his hand slightly to start pullup. Bet this man's first stop was at the PE shop for some new mittens.



APPROACH END ENGAGEMENT. He lined up in wing position, everything checked, he acknowledged Lead's signal, they began to roll, he went into burner, felt the reassuring "whap" and the smeared tire marks began to blur as he accelerated. Suddenly, at about 100 knots, his bird decelerated and Lead left him. He thought he'd lost burner. Mobile advised what had really happened. The jolt when the afterburner had cut in had jarred the arresting hook loose and it caught the BAK 9 barrier. No further difficulty was encountered in aborting the takeoff. Cause was attributed to a worn tail hook shackle assembly.

(*Ed. note*: *We trust the fix was not "bolted in stowed position" as was done in one case when the tail hook wouldn't remain in the stowed position.)*

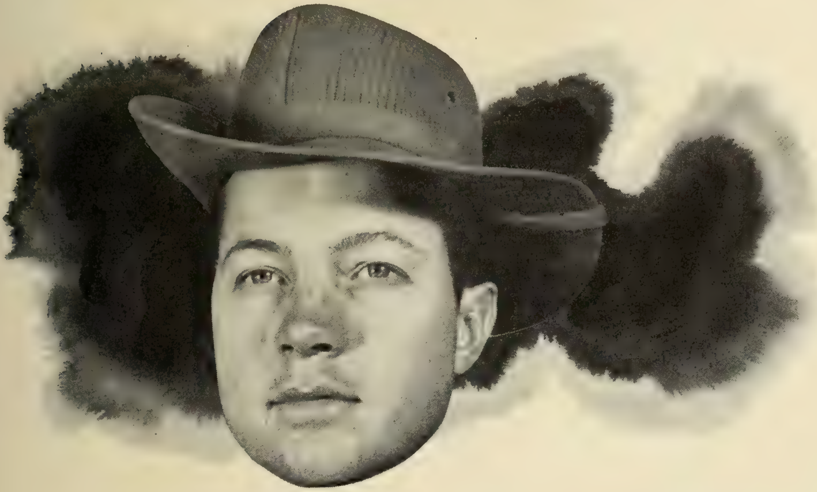
ROUGH AIR—Aircraft commanders of transport type aircraft often have to make the determination as to whether or not to turn on the seat belt sign. On takeoff and landing, when cumulus clouds appear ahead, when flying over deserts at low altitude in summer, these situations are easy: always have the seat belt sign on. But when a few tremors tickle the plane, the weather has been smooth and it's clear ahead, what then? Will the turbulence increase, or is it to disappear altogether in seconds? Should the pilot be alarmed, especially if, a few hours previously, when the forecast was written on the Form 175 there was a dash drawn through the turbulence block?

About the only answer can be: If in doubt, turn on the seat belt sign. Okay, if *always* in doubt in a case like this, *always* turn on the seat belt sign. Then hope that all passengers comply, immediately! Let's take a case.

A VC-47 pilot planned a cross-country, obtained a weather briefing by drop line and was given a no-turbulence forecast. Passengers were briefed, including the use of seat belts. Takeoff and climb were uneventful and cruise at 13,000 was smooth. Over Wyoming, and nearing destination, descent was made to 11,000. At this time light to moderate turbulence was encountered. The aircraft commander turned the seat belt sign on and almost immediately severe turbulence was encountered. A passenger who had not yet fastened his seat belt was thrown to the floor of the aircraft and chest pack chutes and chute harnesses were dislodged from overhead racks, striking the fallen passenger. He suffered a scalp laceration and concussion and was unconscious for three or four minutes. The pilot radioed ahead and had a doctor and ambulance meet the aircraft.

One other point: Loose items must be properly stowed, and coats only should be stowed in overhead coat racks. Brief cases should be shoved under seats or stowed with luggage and all cargo should be properly secured with tiedowns.

WELL DONE



SMSGT DONALD D. DIXON

319 TROOP CARRIER SQUADRON, HURLBURT FIELD, FLORIDA

Senior Master Sergeant Donald D. Dixon, loadmaster on a C-46, has been selected for the USAF Well Done Award.

During a flare dropping sortie in support of an A-1E night gunnery mission, it was Sergeant Dixon's duty to arm and load the flares in the dispenser installed in the door of the aircraft and to release them on the pilot's signal. The flares being used were MK-24's of two million candlepower.

Sergeant Dixon had three flares armed and loaded for immediate release. Upon the pilot's signal, he actuated the release mechanism. Two of the flares released normally, but the third jammed part way down the launcher tube when the metal coupling of the lanyard wrapped around a brace of the flare dispenser. Sergeant Dixon immediately recognized that the five second delay feature of the flare's explosive parachute ejection system had been initiated. The potential danger to the crew and aircraft permitted only seconds to act. Sergeant Dixon, with no regard for his personal safety, first attempted to loosen the entangled lanyard. Unable to do this, he pushed the flare out by hand. As the flare cleared the dispenser, the parachute ejection system exploded, causing deep lacerations and first degree burns to his right hand. However, the jammed flare fell free of the aircraft before igniting.

Sergeant Dixon's prompt decisive action prevented further development of a dangerous situation which could have resulted in the loss of six crewmembers and a valuable aircraft. WELL DONE! ☆

For Meritorious Achievement in Flight Safety for the period 1 January through 31 December 1964, the units listed here have been selected to receive the Air Force Flying Safety Plaque. The stringent criteria insure that each recipient has achieved an outstanding flying safety record while maintaining mission capability.

Flight Safety Awards

AAC	• 5017 Operations Squadron, Elmendorf AFB, Alaska
	• 317 Fighter Interceptor Squadron, Elmendorf AFB, Alaska
ADC	• 4780 Air Defense Wing, Perrin AFB, Texas
	• 328 Fighter Wing, Richards-Gebaur AFB, Missouri
	• 4603 Air Base Group, Stewart AFB, New York
AFSC	• Air Force Flight Test Center, Edwards AFB, California
ATC	• 3510 Flying Training Wing, Randolph AFB, Texas
	• 3500 Pilot Training Wing, Reese AFB, Texas
MATS	• 9 Weather Reconnaissance Group, McClellan AFB, California
	• 1611 Air Transport Wing, McGuire AFB, New Jersey
PACAF	• 315 Troop Carrier Group, Tan Son Nhut Air Field, Viet Nam
	• 6091 Reconnaissance Squadron, Yokota Air Base, Japan
	• 15 Tactical Reconnaissance Squadron, Kadena Air Base, Okinawa
SAC	• 5 Bombardment Wing, Travis AFB, California
	• 43 Bombardment Wing, Little Rock AFB, Arkansas
TAC	• 12 Tactical Fighter Wing, MacDill AFB, Florida
	• 474 Tactical Fighter Wing, Cannon AFB, New Mexico
	• 612 Tactical Fighter Squadron, England AFB, Louisiana
USAFE	• 20 Tactical Fighter Wing, RAF, Wethersfield, England
	• 526 Fighter Interceptor Squadron, Ramstein Air Base, Germany
AFRES	• 349 Troop Carrier Wing, Hamilton AFB, California
	• 442 Troop Carrier Wing, Richards-Gebaur AFB, Missouri
ANG	• 158 Fighter Group, Burlington Municipal Airport, Vermont
	• 140 Tactical Fighter Group, Buckley ANG Base, Colorado

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AEROSPACE
SAFETY
UNITED STATES AIR FORCE

JUNE 1965

AEROSPACE
SAFETY

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FALLOUT

I'VE GOT IT!

Recently I read the article "Double Your Proficiency Flying Time" by Col. Robert D. Curtis (April issue, page 25), and decided to try out the recommendations.

Immediately after lift-off, I called out from my hooded position in the rear cockpit, "I've got it!"

"The hell you have," came the voice from the Navy Captain in the front seat.

What do I do now, Colonel Curtis?

CDR Donald M. Layton, USN
USN Postgraduate School
Monterey, California

Punt?

ARE YOU A FORGETTER?

Congratulations to CMSgt Al Pitts, of Andrews AFB Transient Maintenance, for his excellent "from the shoulder" article that appeared in AEROSPACE SAFETY (March) titled "The Other Side." It is my opinion that more articles should appear in AEROSPACE SAFETY or AEROSPACE MAINTENANCE SAFETY to bring to the forefront what should be considered normal expectations of Transient Services. Any means necessary to arrive at a more complete understanding between aircrews and the Transient Services at their RON bases should be readily accepted and encouraged. I believe articles in this area should be treated with the idea of achieving this better understanding, rather than a source of complaints column. Too frequently we are invaded by the men from space who, indifferent to healthy maintenance standards, also add vexation by bringing some malignancy on the AFTO Form 781A that was incurable at the home base, in the hopes that some sympathetic soul might diagnose their case and provide a remedy. Many times the impatient jockey feels that "a minimum of time" precedent should be set on his particular air vehicle, and that the other birds on the air patch are merely decoys, and require no attention.

Then too, there are those who are used to operating at their home station with all facilities and equipment available that are required for their particular aircraft, and feel that they should be accorded the same treatment. I really don't believe that the average pilot realizes that the required facilities cannot be obtained on a short order basis. Also, in many cases, maintenance can be performed on these aircraft only because some personnel in certain skill levels are still around who were programmed in on the basis of a particular type of aircraft being assigned to the unit.

The entire subject of fewer transient services being available, as more restricted manpower controls become effective, has been thoroughly covered in a TIG Brief (28 Aug. 64). I still do not feel that this message has been received.

I have in mind a recent occurrence at my own base, where a jet aircraft arrived and the airman who was servicing it was instructed by the pilot not to open the canopy, as the aircraft was equipped with catapult seats. The pilot then left, and while fuel servicing was started the airman noted fuel spewing from

continued on page 28

THE ENEMY WITHIN

One of the most formidable military air forces in the world was partially knocked out of action last year. We, the U.S. Air Force, get credit for this "victory." We crippled a combat air force, together with much of its support air arm and many of its trained personnel. Just to give you an idea, here's a partial box score:

170 Single-engine fighters
39 Twin-engine fighters
39 Bombers

Bear in mind, this is only a partial tally. "Kills" were also recorded on trainers, cargo aircraft, helicopters, missiles, miscellaneous ground vehicles and support equipment. "Victories" were achieved both in the air and on the ground.

As could be expected, destruction of a force of this magnitude was costly. Regrettably, these victories resulted in losses of our own. Our dollar cost alone ran about a million dollars a day. Our combat capability was reduced an amount equivalent to that of the "enemy."

The ironic aspect of this situation — none of it was intentional, every bit was accidental!

I have not altered the facts. I merely reversed the normal outlook in an effort to call attention more dramatically to the tremendous Air Force loss, through accidents, during 1964.

1964 is history. There is little we can do about it, so let's concern ourselves with 1965. The outlook is encouraging. I am keenly aware of the concern of the Air Council, Air Staff and the commanders of the major commands. There can be no question that accident prevention is receiving top level backing. All the using commands, the supporting commands and industry are teamed in an effort to solve some of our most difficult problems. Recently an Air Force-Industry team visited all F-100 bases in this country and Europe. Aerospace safety project officers and engineers, an AMA representative, and a pilot and two engineers from North American made up the team. Their job, in essence, was to talk to as many pilots and maintenance personnel as possible, discuss past F-100 accidents, explain some of the F-100 problems we have been having, answer questions and suggest techniques and procedures which can make accidents less likely. Believe me, they were out also to observe and pick up any clues that might be used to make the training and tactical employment of this aircraft safer.

Here's another example of top level command concern for safety. Because of a series of unexplained C-133 accidents, the fleet essentially was grounded. Two aircraft were turned over to AFSC for extensive flight tests. Concurrently, other selected agencies were reviewing in detail prior difficulties experienced with this aircraft. It will fly again, and be safer and more reliable.

But, while these are problems receiving priority attention, we cannot neglect our normal routine precautionary measures. Let me cite a case to show what can happen if we do. An F-104 pilot, scheduled for a gunnery mission, decided to abort when warning lights came on during the takeoff roll. He retarded the throttle and pulled the drag chute handle. No chute. At first he thought he would be able to retain his external stores and still be able to stop. Then, approaching the end of the runway, he realized he was going too fast. He extended the tailhook and made a successful BAK-9 barrier engagement. The fighter stopped in 50 feet. No damage. This was merely an incident. But, let me stress the fact that often the only difference between an incident and a serious accident is degree. The reason the drag chute failed to deploy was quite simple — it had not been installed. The crew chief had failed to do his job. He had failed to perform a proper preflight but the pilot would have caught it had he made a proper walk-around inspection. All the high level interest in the world cannot eliminate or assume responsibility for carelessness of this sort.

Think about one more statistic — 911. This is the number of Air Force officers and airmen killed last year by accidents. As I pointed out earlier, there *is* tremendous team effort to clear up major trouble areas. This effort will continue. But we can never defeat our enemy within unless we wipe out carelessness and insist on professionalism at all levels in our own ranks. If we are to have a more favorable box score in 1965, this is one irrefutable requisite.

Jay T. Robbins

JAY T. ROBBINS
Brigadier General, USAF
Director of Aerospace Safety

Early in 1965, in an effort to reduce the number of F-100 aircraft accidents, a special briefing team visited all ZI and USAFE bases using this airplane. Members of this team came from the Directorate of Aerospace Safety, North American Aviation and the Sacramento Air Materiel Area. The three articles which follow were adapted from presentations by members of this team.

Save A Hundred

By Lt Col Eugene P. (Gus) Sonnenberg
Directorate of Aerospace Safety

During my tour in the Directorate of Aerospace Safety, I hope to achieve a personal safety goal. I want to save one F-100 and one pilot who might otherwise be lost in an accident. This may seem modest for four years work, but remember, this saving comes to a million dollars and pays my salary for almost 70 years.

I hope to make some progress toward this goal by showing you fighter pilots how some F-100 accidents and incidents occurred and by doing so, alert you to areas that are very worthy of caution. Incidentally, if there are some pilots present who fly other than the F-100 I invite you to stick around; some of the suggestions apply across the board to all fighters.

First, a quick look at the F-100 record:

MAJOR ACCIDENTS	
1962	65
1963	52
1964	47

What causes accidents?

Pilots cause some of them, usually because they exceed their limitations or those of the aircraft, or because they are inadequately prepared for an emergency.

About the Author Lt Col Eugene P. (Gus) Sonnenberg, F-100 project officer, has had outstanding careers both as a Naval aviator and Air Force pilot.

As a WWII Navy dive bomber pilot, he had an impressive record in sinking enemy ships and destroying aircraft both in the air and on the ground.

As an Air Force pilot during the Korean conflict he flew 100 close air support missions in Republic F-84's. He subsequently became an Air Force experimental test pilot, test flying the F-84F, F-86H, F-100, F-104 and F-107, also French and Italian fighter planes. He won the Thompson Trophy Race in 1954 to set a 100 km. closed course record in a North American F-86H Sabrejet.

Pilot fatalities in the F-100 are somewhat higher than the USAF rate, which is about 2.0. What follows has been said many times but bears repeating:

- Rehearse your ejection procedures on the simulator and do this while wearing *all* of your flying equipment, especially your gloves. Practice timing so you will know exactly how much time it takes YOU to eject.
- Know your personal equipment. Knowing how to release the chute is *vital* for ejecting over water or in high winds.
- Select exact limits for specific emergencies and stick with them. For example: No more airstarts after 3000, EJECT! Uncontrolled flight at 10,000, EJECT!

Flight control malfunctions and uncontrolled flight conditions such as spins are insidious — spins because the pilot may believe his aircraft is just about ready to recover and he will stay with it too long, trying. With a flight control malfunction, warning lights normally DO NOT COME ON. Nor are there any other danger signals. It is only rarely that the malfunction of the flight control system has a warning light or instrument danger signal, since most malfunctions are mechanical. Personal experience, during a horizontal stabilator disconnect, convinced me that a pilot has a tendency to delay ejection far too long while experimenting — perhaps even momentarily disregarding altitude. For years, when I pulled the stick back the nose always came up. Now I was getting no result but I kept moving the stick fore and aft and trimmed. I didn't get out right away. Had I been at a lower altitude, I'm sure this would have been fatal.

Materiel failure is another major accident cause. In the same breath I want to add that maintenance error enters here; it is most difficult to determine, from accident debris, whether a component failed because it exceeded design limitations or from improper installation or adjustment. I have been making a very strong appeal to the maintenance people and point out that the moments they steal from a task can cause a pilot's death.

From an analysis of F-100 accident and incident reports, all of which come across my desk, the doors that will most likely lead to accident prevention in the F-100 are plainly marked in big black letters: FLIGHT CONTROL MAINTENANCE and PILOT FACTOR. In the three-year period ending in 1964 there was a total of 53 accidents that were traced to or suspected to be caused by malfunctions of the flight controls or to pilot factor. Let's break these into common groupings.

Five pitch-up accidents on takeoff. In four of the accidents we lost the pilots. In the fifth, both pilots ejected from an F and were available to give valuable testimony to the accident board. From them we learned what happened. As the pilot pulled back on the stick the nose came up prematurely, as though the pilot in the rear seat had pulled the stick back and was holding it. The pilot pushed forward but by that time the aircraft had pitched up to about 150 feet. He couldn't regain control. Both pilots ejected successfully. The exact malfunction in the flight control system was never pinpointed; however, had the pilots not escaped, very likely this accident could have been given a most probable cause tag of pilot factor since it looked exactly the same as others that have happened. This type accident can result from a malfunction, also from a pilots' pulling his aircraft off prematurely.

We have had five pitch-up accidents on base leg and on the turn to final for landing. In one the pilot punched out successfully and reported that the control reactions were similar to pitch-up on takeoff. The stick came back in his lap and at 150 knots he went out.

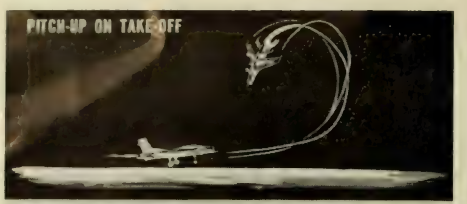
Earlier a similar case occurred but the pilot felt that he was regaining control. He brought the bird in. Investigation of this incident revealed many minor discrepancies in the flight control system but none to definitely isolate the cause. This incident was incompletely investigated — had a thorough analysis of the aircraft been made, possibly a cause factor could have been isolated.

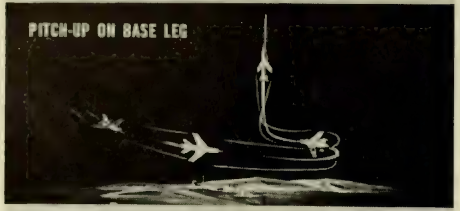
The next group we classify as join-up loss of control. Three recent accidents of this type followed the same pattern. Approach to the formation was being made from the rear and the aircraft went into a barrel roll type maneuver, culminating in loss of control. No pilots have recovered from these accidents. However, two years ago an incident of this type was traced to a faulty engage switch in the autopilot system which permitted the autopilot to take over momentarily.

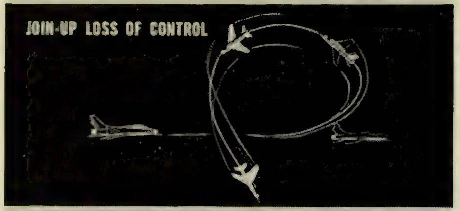
Another category we classify as pull-up off target. This type accident involves passing over the target, initiating the climb then getting a rapid pitch-up. This can be caused by a malfunction of flight controls, of course, and also by pulling too hard and turning too soon, getting a very high angle of attack and stalling the bird. A definite cause factor for this type of accident has never been established.

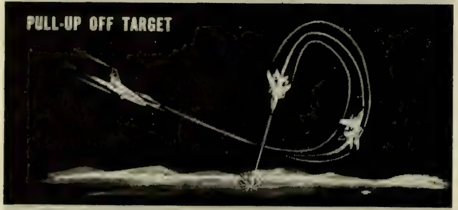
Pitch-roll on the gunnery range is another accident category. Normally, this type is attributed to pilot factor. The maneuver itself is relatively simple, permits error, and yet we have lost three airplanes in the turn from base to final in the last three years, and we've lost two in the final turn to the high angle delivery.

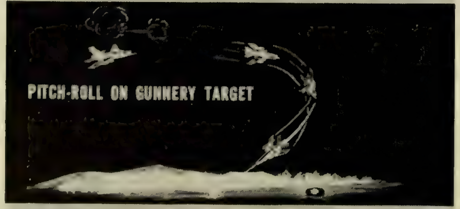
The most puzzling of these is the loss of control during turn to base leg for strafing or napalm delivery.

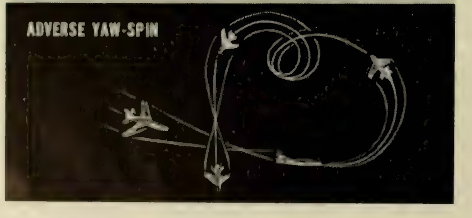












I believe this is a pilot factor-adverse yaw situation. I flew the gunnery pattern several times not long ago and found pilots were normally pulling as much as 4G in this turn. If you pull slightly more than 4G in this turn, throw in some trailing winds and have a heavily loaded bird, you can get into trouble. Just remember, if you are overshooting the turn to final, don't try to salvage the bad pass. To determine all the unsafe parameters in the gunnery patterns, North American Aviation is going to be asked to evaluate the pattern speeds with various common loads.

In the past 10 years we have lost more than 50 F-100's due to spin and adverse yaw. The majority of these accidents have occurred during Air Combat Maneuvers (ACM). These losses should be inducement enough for us to respect anything which might lead to this type flight condition. Even relatively minor flight control discrepancies must not be treated lightly. You must report all of these discrepancies and the corrective action taken. At one base I observed an autopilot check that was — well, I'll call it a little strange. Since the autopilot wasn't to be used, the bird was accepted. It should have been turned down. Further, report and repair those aircraft that exhibit out-of-rig flying characteristics.

There's another category, hard to evaluate exactly, but certainly suspect over the years, and that's the accident that stems from pressing the target. Pilots working for good scores can be tempted to press a little too close, then not always get out. There have been some adjustments made in weapons delivery techniques and we believe that problem has been solved, insofar as technique is concerned. So much for the accidents.

Here is something else I believe to be of great significance. During the past three years we have had 158 flight control incidents reported. These included all manner of gyrations, including pitch-down, pitch-up, roll, yaw — and all were due to flight control or autopilot malfunctions. In many cases these incidents would have been accidents had they occurred at low altitude or had it not been for the skill of the pilots in handling the emergencies.

To isolate a flight control problem, if one exists, North American Aviation has a contract to instrument and flight test four F-100's. These airplanes will be analyzed from nose to tail, component by component, to include all the bits and pieces of the flight control autopilot system. They are to determine how much deterioration we have had during the past 10 years. Also, as a part of this test, we are going to run flight tests and try to duplicate the various malfunctions we have experienced: bent bungees, sticky slats, runaway trim. We want to find out how much latitude a pilot has when these emergencies occur.

In the meantime, one thing all pilots can do is to make detailed write-ups of all discrepancies, particularly flight control discrepancies. Often a pilot's write-up at the conclusion of a flight is known to be well merited, but no deviation from normal can be detected by maintenance personnel. If this happens, and if the maintenance people have completed the SMAMA flight control checklist, then call SMAMA for help. In cases of this kind, a team from North American Aviation, SMAMA and the Directorate of Aerospace Safety will respond whenever and wherever possible.

No stone is being left unturned by Aerospace Safety, North American Aviation or SMAMA to ferret out a problem in the control system if it exists, in an effort to make your flying safer. My suggestions are:

- Don't exceed your limits.
- Don't exceed the airplane's limits.
- Report, accurately, all discrepancies.
- If you still have problems, don't just live with them — call for help.
- When you are faced with an ejection situation due to a major flight control malfunction, such as a disconnect, don't hesitate. BAIL OUT! (And about the bailout: decide ahead of time what your altitude limits are and when they are reached — if things aren't under control, "Sayonara, G.I.") ★

F-100 Flight Control System

By Kenneth Pratt
Sacramento Air Materiel Area

Mr. Pratt is F-100 Supervisory Maintenance Support officer, Sacramento Air Materiel Area. Many of his comments apply to other aircraft as well as the '100. Mr. Pratt has been associated with the F-100 since it was first selected for the Air Force inventory and is considered one of the most knowledgeable men in the maintenance and engineering fields.

The importance of thorough preflight inspections cannot be over-emphasized. These checks should not be made unduly time-consuming, but must be complete since each step is intended to check a different feature of system operation. Most pilots and maintenance people who have been in the business a long time realize that the little things can make the difference between success and failure. For example, *reading* a gage instead of just glancing at it to see if everything is in the green; bleeding the air from the hydraulic system instead of merely adding more fluid.

Our experience indicates that a fertile area for improvement may be during the after-start checks. These checks involve the interpretation of various important indications. Know your systems and you will recognize a sick bird. The important thing to remember is that a thorough knowledge of the system and a few extra seconds spent during the preflight may prevent serious trouble during the flight.

When you have an inflight malfunction, the postflight inspection is where the pilot and maintenance team effort should start. Prior to engine shutdown is the best time for a pilot to explain or demonstrate the exact nature of an unusual discrepancy. Quite often the demonstration of a defect will provide motivation to the maintenance team. Such motivation might otherwise be lacking if the defect is not apparent during a later check.

The debriefing must also be a team effort and pilots should be afforded a debriefing that includes a member of each affected specialist branch. This will assure that the program is understood, and that all pertinent factors are recorded.

Pilot write-ups have been the subject of much criticism. Some of this is undoubtedly warranted, but frequently there can be more than one meaning attached to the same words by different individuals. Therefore, the responsibility for usable form entries must again be a team effort. The elimination of vague or ambiguous phrases and inadequate descriptions can only be accomplished through coordinated effort by both pilots and maintenance personnel.

TESTS PROGRAMMED

A program was recently contracted to North American Aviation to evaluate the condition of the F-100 flight control systems. Four aircraft will be used in the investigation: two D's, one F and one C. The airplanes will first be instrumented and flown to obtain basic performance data. Systems test will then be conducted and will include an evaluation, using a stick force recorder. The new recorder charts will then be compared to original factory recordings to determine the extent of system deterioration. There will also be new tooling developed to measure free play between the stick or rudder pedals and the control surfaces, and free play limits will be established.

When all components have been renewed, or checked OK, the aircraft will again be ground-checked and flight tested. The results of this investigation will then be applied to our F-100 heavy maintenance program and should enable the flight control systems to adequately perform throughout their extended service life.

A malfunction simulation phase will also be included in the investigation for the purpose of evaluating the effects of various types of failures. It is hoped that this phase of the investigation may shed some light on recent accidents that have apparently involved failures of an unknown nature in the flight control systems.

In conclusion, 1964 was the safest F-100 year. 1965 is up to YOU! ★

Be An Old Smoothie

By Robert A. (Bob) Hoover
Manager, Customer Relations
L.A. Division
North American Aviation, Inc.

Mr. Hoover is one of the foremost aerial maneuver demonstration pilots. He has specialized in exhibiting maximum performance capability of F-86 and F-100 aircraft. A WWII fighter pilot, Mr. Hoover is a graduate of both Air Force and Navy test pilot schools.

I can remember when the measure of a pilot's skill was how tight he could crank the bird around the traffic pattern. When he became sharp enough he would peel up right from the deck, holding the maximum number of G and not touching the throttle until ready to clear the runway.

We lost a lot of pilots with that technique. Of course, we had the excuse that we could get it on the ground if the engine quit. I don't think we ever lost many airplanes due to engine failures at this stage of the mission, but we sure lost a lot due to this exacting traffic pattern.

We began to wisen up when we moved into the century series aircraft. Our wing loadings were much higher than we had ever experienced and because of the swept wing we encountered high angle of attack problems not evident with earlier aircraft.

The patterns you are now flying are the result of a lot of research. From what I have observed, pilots

now try to fly the traffic pattern with controlled speeds. You simply can't get too good at flying traffic patterns. Flying the airspeed accurately and really sticking with it will consistently put you on the touchdown point at the right airspeed. It's worth recalling that, for each additional 10 knots of airspeed on touchdown you can expect another 1000 feet of ground roll. For my part, it's comforting to come into a 7000-foot runway when you know you've got speed control and know you can consistently hit that touchdown point. You need your utmost skill going for you when it's a dark rainy night with a 7000-foot runway and you wonder if this might be the time the drag chute fails.

It's important to control airspeed throughout the traffic pattern, especially when we consider that as we crank the bird into a bank the stalling speed goes up. True, we learned this a long time ago, but let's consider another input — G's. I've flown with pilots who pull a bit more G than I like to see in the traffic patterns. Once you tighten the turn, the stalling speed runs way up and the recommended pattern speeds are no longer acceptable.

The speeds that are recommended are based on holding approximately one G flight. I am sure that some of our past accidents can be attributed to this problem of pulling excessive G. The exact same problem exists in the gunnery pattern. With abrupt excessive G you can go right through all the stall warning signals to an accelerated stall condition.

Let me explain some of the basics of what happens to a high performance airplane like the F-100 when you try to exceed its stable flight design limits. We'll start with adverse yaw. Any airplane that has ailerons is subject to adverse yaw. When you start a turn the nose has a tendency to move opposite to the direction of desired turn. Turn on your gunsight, align it with a spot on the horizon and start a turn—you'll see what I mean. When are you most likely to encounter adverse yaw? When flying at slow speeds and high angles of attack and pulling G, as in the traffic pattern or at high altitudes during ACM.

There is no need to fear adverse yaw, or any other abnormal flight situation. I think this is a most honest airplane. When we tested it originally I couldn't get it to go out of control. I really worked and worked. It was weeks before I could set up a condition that would make the airplane do something it didn't want to do in the first place. I stalled the airplane in every possible attitude: straight up, slid it backwards on its tail, racked it into tight turns, and attempted to enter spins. All I had to do to stop it from whatever condition I had forced it into was to neutralize the controls and the bird would weather vane itself out and start flying again. That's in your flight handbook.

For spin recovery there is a certain technique, but before you apply this technique, you ought to really know whether you are spinning or not. You can tell. Just let go of the controls and if the airplane is definitely rotating then you know you are starting in to a spin. Also, always check your airspeed. Airspeed will be pretty slow if you are spinning. If you've got plenty of airspeed you are in a spiral. Neutralize controls and the bird will fly right out. If you are in a spiral but think you are in a spin and use spin recovery technique—stick all the way back, rudder opposite the rotation and aileron with—all you are going to do is force the airplane to continue the spiral.

So-o-o-o, the procedure is: check the airspeed to determine whether you are spinning or spiraling. If spiraling, neutralize; if spinning, use the handbook procedure. You'll be out in approximately two turns.

In the early days of the F-100 we considered clap-trapping the bird with warning devices—stick shakers, and the like—but we decided, after evaluation by company and Air Force pilots, that such devices are not needed. When the wingtips stall and the nose wants to drop — RELAX! Neutralize the controls and you'll be flying again, altitude permitting, of course. Bear in mind that your ailerons are the most effective controls. Don't try to force the bird on through with use of ailerons. If you are pulling through a maneuver and she starts to protest, don't use ailerons—use rudder and let it come right on through. It's just amazing how the airplane will always end up pointed downhill and building up airspeed if you just stay off the ailerons.

In all my tests of the F-100 I found one uncontrollable condition —the flat spin. At a high angle of attack I got the airspeed down to about 110 knots, then, stick all the way back, I slammed in full cross control—right rudder and left aileron. On that particular occasion I was able to get the airplane into a flat spin. I had to hold this control configuration for three turns for the test requirements and when I went through the recovery technique I couldn't recover. I used every technique we thought might help, including an attempt to light the burner, but was unsuccessful and I had to leave it 22 turns later. Of course, that time we were still experimenting with the best techniques for recovery.

Let's sum up spin recovery—just in case you should manage to force the plane into one. Do as the book says, and I stress this, no matter what type of spin you are in: stick back, ailerons with and opposite rudder. Don't think of anything else. Sit there and hold that. Also, remember never to play with any uncontrollable situation below 10,000 feet. Eject!

In conclusion, I have spent considerable time discussing the worst situation you might be able to get into in the F-100. If you fly it like it should be flown, don't suck it in abruptly in the pattern, don't slam the controls around—especially aileron, don't try to force it through a maneuver when it's protesting, you'll have no trouble.

Every time I fly I have the personal goal of trying to do a little bit better. I try to keep that ball in the center at all times. I know that the smoother I can handle the controls the more performance I can expect. I can fly it faster, or slower, or more precisely through an intricate maneuver. If you want to get the most out of your F-100, or any other airplane for that matter, be an old smoothie. ★

WHO'S IN CHARGE HERE?

Lt Col James S. Keel, Directorate of Aerospace Safety

The title for this story was taken from an excellent article published in a recent issue of a major air command safety magazine. Many accidents and near accidents were cited, all pointing to one conclusion: An aircrew is "a bunch of guys with different skills driving an airplane." But the hooker is, "LED BY ONE MAN WHO IS IN CHARGE." The obvious inference is that, what can be a "bunch" driving the machine, can become, with proper leadership, a well-coordinated group, highly trained and motivated for their profession, working under the command of one man toward a common goal.

The goal for the transport mission of the Air Force is moving the airplane with passengers or cargo from point to point. But here is another hooker. *The key to success is doing the job without busting someone or something.*

A recent minor accident involving a four-engine transport is an example of how a compound emergency resulted in a breakdown of command and control.

The aircraft, with crew of nine and three passengers, departed a Pacific island base for the West Coast with approximately 23,000 pounds of cargo which consisted of 463L aluminum pallets and nets. At 9000 feet, shortly after passing ETP, with the second engineer at the panel and the aircraft commander in the left seat, a zero ampere-zero volt condition was noted on Nr 3 generator. Since an overheat condition was not indicated, the aircraft commander directed a physical check of the generator.

In consideration for the lesser experience of the second engineer, the first engineer elected to check the generator. He proceeded through the right wing crawlway to the Nr 3 nacelle where he found the generator loose and wobbling erratically. The decision was to remove the generator, which necessitated engine shutdown. This operation consumed slightly over an hour. (For those not familiar with this frequent requirement, it's cold, it's dark, the noise level is tremendous because of wind blast, space is confining. When flight engineers are directed to remove generators during flight, they undoubtedly reflect on the attempts that have been made over the past 14 years to design and install a flight-deck-operated generator disconnect device—one that would eliminate the difficult task of going through the crawlway to the nacelle and physically removing the generator to prevent fire.)

After the failed generator was removed, the engine was restarted and the first engineer went back to the flight deck. While climbing the crew ladder, he noticed a momentary loss of cabin lights with immediate recovery to full intensity. Meanwhile, anticipating a complete loss of electrical power, the second engineer, at the panel, without coordinating with the aircraft commander, split the bus, started the GTU and brought it on the line. This caused loss of essential bus operation for about 30 seconds. The effect was complete loss of pilot's instrumentation and lighting, necessitating use of flashlights. Immediately thereafter, a zero ampere-zero volt condition was noted for the Nr 2 generator. Another check by the first engineer, this time to the left wing and Nr 2 nacelle. He found the same condition—the generator loose and wobbling erratically. Identical problem—identical decision!

Number 2 engine was shut down for generator removal. The fire control lever was used for engine shutdown, but instead of the prop going to full feather, it began windmilling counter-clockwise. The second engineer could not stop the windmill by using the manual prop control, and the first engineer returned to the flight deck to assist. Just as he arrived at the panel, Nr 3 engine surged to 2600 rpm with zero torque and zero fuel flow indicated. The first engineer traded seats with the second engineer. The aircraft commander called for METO power on one and four and directed that efforts be continued to restart either two or three. As altitude could not be maintained on two engines, descent was begun and Airways was contacted for intercept. Airspeed was reduced to 130 knots, 10 degrees of flaps were lowered, and the aircraft commander directed the loadmaster to jettison cargo.

The elevator platform with about 5500 pounds of cargo, including 44 pounds of registered mail, was immediately jettisoned. Altitude at this time was 8000 feet. The cargo hoists could not be used because of the possibility of overloading the aircraft electrical system, therefore, all aircrew members (except the aircraft commander, first engineer and navigator) and passengers manually dropped cargo on the closed elevator doors. The load was then salvoed by opening and closing the doors. On the third salvo, a piece of cargo lodged against the rear elevator bulkhead and was held flat in this position by the slipstream. This caused a speed brake effect with light to moderate aircraft buffeting. Attempts to dislodge the piece of cargo were unsuccessful until another piece was dropped which caused both to fall free. These pieces struck and caused extensive damage to the area behind the bulkhead. The dislodged piece rolled beneath the right underside of the aircraft, narrowly missing the right stabilizer, but causing numerous tears in the aircraft skin.

While the cargo was being jettisoned, the first engineer made several unsuccessful attempts to restart Nr 3 engine; the propeller was finally feathered to reduce drag. He then discovered the fire control lever for the Nr 2 engine in the aft position which had prevented the second engineer from previously feathering the Nr 2 propeller with manual control. Consequently, by placing the fire control lever in the off position, prop control was regained for Nr 2 and it was restarted and placed back in normal operation. Altitude at this time was 5300 feet. Since the aircraft was on three engines instead of two and altitude and airspeed could be maintained, the aircraft commander directed the loadmaster to cease jettisoning. This was relayed by the second engineer who was now on interphone in the cargo compartment. Due to the noise level he was unable to get the message to the loadmaster, so he resorted to a hand signal, indicating a cutting motion across his throat. The loadmaster interpreted this as a ditching signal and began ditching preparations. Continued efforts by the second engineer led to correct interpretation by the loadmaster and jettisoning was discontinued. By this time, about 12,000 pounds of cargo had been jettisoned. Nr 3 engine was then restarted, and, with the aircraft again on four engines, climb was made to 7000 feet. Airspeed was maintained at 160 knots to prevent further damage to the aircraft structure; successful intercept was made and the aircraft continued to an uneventful landing at its destination.

Significant findings by the investigating board were:

- The primary cause was attributed to the second engineer who did not follow his engine failure checklist, which in turn compounded the emergency and delayed engine restart at a critical time.
- There were many contributing causes assessed; primarily, the aircraft commander did not insure that the engine failure check list had been completed, information on jettisoning is not adequate in the Dash Nine T.O., and maintenance inspection of generator mount bolt torque is not sufficient to provide timely detection of failed or failing generator studs.

The *simple* lesson to be learned from this accident is quite obvious. The second engineer failed to complete his engine failure check list after he used the fire control lever to shut down the Nr 2 engine. Repositioning the lever to the off position is an item on the checklist; such action was an absolute necessity in this instance since the corresponding prop selector on the manual prop control quadrant is automatically disengaged until the fire control lever is returned to its normal off position.

But, what about the *complex* lesson? What about the distraction factor when the scanner advised that the Nr 2 prop was windmilling backwards, which caused the engineer to divert his attention from the checklist? What made him attempt to control the counter-rotating prop with an inoperative control which he had de-energized with the fire control lever? Was his training a factor? Was his lack of experience a factor? These certainly enter the picture. Regardless, the emergency was compounded at this point. Why didn't the aircraft commander insure that the checklist had been completed? What caused the Nr 3 engine to surge and quit?

First, it is rather obvious that, during the sequence of events that led to this accident, the man driving the machine had his hands full. He, too, was most assuredly in a situation that was distracting to say the least. Secondly, the board found that just prior to the time Nr 3 surged, fuel transfer was in progress. Moreover, carburetor icing could not be ruled out as a possibility. But the reason for zero fuel pressure, which caused Nr 3 to quit, could not be determined.

In conclusion, the investigation of this accident brought out that positive overall crew control and coordination were deficient. There were times when the aircraft commander could not obtain information and/or was not aware of events as they developed.

Returning to the title of this episode, "Who's In Charge Here?" put yourself in the left seat, at the panel, or out in the nacelle during this particular mission. With the advantage of "Monday Quarterbacking," could this happen to you? Could you have prevented it? Would you have fared as well? Or, would the next day's headlines read:

"LARGE MILITARY TRANSPORT DOWN AT SEA – 12 ABOARD—NO SURVIVORS!" ★

THOSE SHIFTY FLOWS OF FUEL

An expert from MOAMA explains unscheduled fuel flow shifts in the F-105 and what really happens when "emergency fuel" is selected.

By Ross J. Lindsey,
Equipment Specialist,
F-105 Tech Services Br.,
MOAMA, Brookley AFB, Ala

Unscheduled shifts in fuel flow and lack of throttle response, as every pilot and maintenance man knows, are about as welcome as the German Measles on the eve of a wedding. Shift magnitude can vary in intensity from a gentle rocking chair effect to a kick in the posterior that would do credit to a Missouri Mule, and range from little or no indication on engine support instruments to clocking of fuel flow indicator, rapid loss of exhaust gas temperature, engine pressure ratio, RPM unwinding, and in some cases complete engine flameout.

There are several possible causes for symptoms of unscheduled fuel flow shifts, some of which are improper maintenance, power lever management, fuel management, gun fire, aircraft fuel system malfunction, J.C. maneuvers, etc. However, comment will be restricted to events directly related to the fuel control.

In early 1963 a joint Air Force-Industry F-105 Flameout Team was formed to gain on-site knowledge of reported engine fuel control malfunctions. The first efforts of this team were in USAFE during January 1963 to investigate repeated instances of inflight unscheduled fuel flow shifts. By improvising test equipment, a condition could be induced which caused fueling through both normal and emergency systems of the fuel control in an intermittent random frequency during block test operation of the engine. Shuttling of the fuel transfer valve resulted in fuel flow fluctuation of up to 2500 pph, compressor discharge pressure fluctuation of up to 2.5 psi, small fluctuation of EGT and approximately 10 per cent fluctuation in N-2 compressor speed. Engine instability was very similar in nature and magnitude to that experienced in flight. Reducing replacement interval of the fuel control servo filters materially aided in a sharp reduction of reported inflight unscheduled fuel flow shifts.

TEST PROGRAM

Of more lasting significance, team findings emphasized the requirement for a full scale engine test program. Subsequent engine contractor tests demonstrated that air ingestion, fuel flow interruptions at the fuel pump inlet, or excessive pressure drop across the servo filter, could cause the servo filter bypass valve to open, permitting trapped dirt particles from the filter chamber to enter and contaminate the computing (normal) system of the fuel control. It was further demonstrated that these dirt particles could cause hung starts, lack of throttle response and unscheduled fuel flow shifts similar to those reported. Of considerable significance is that, although several fuel controls returned for investigation did not repeat the reported malfunction on the test bench, they did display evidence of foreign object contamination in the computing side of the fuel control. Consequently, the engine contractors' development efforts were directed toward providing a fuel control more tolerant of fuel system contamination. Work in the fuel control program has produced specific revisions to the control to provide a measure of tolerance to contamination. Changes consist of improved servo system structures, redesigned lever and linkage systems, internal stand pipes and improved filtration. The combined programs have culminated in "Project Slow Stop," the current F-105/J75 fuel control exchange program.

While scheduled modifications will vastly improve one of the more reliable fuel controls on one century series aircraft, let there be little doubt regarding design changes as a panacea for unscheduled fuel flow shifts. Like certain aspects of life, the possibility of an unscheduled fuel flow shift will remain.

EMERGENCY SYSTEM

Recent accidents and incidents have focused attention on reluctance of some pilots to use the emergency fuel control system. One major accident and pilot fatality was charged to lack of throttle response and Dash One deficiency in that the Flight Manual did not, at that time, provide information on procedures to be accomplished with a "hung RPM" condition. Repeated instances have occurred wherein an unscheduled fuel flow shift has been experienced, and selection of emergency fuel system resulted in normal operation; then the pilot elected to again select normal fuel system and experienced a second unscheduled fuel flow shift. Perhaps a lack of understanding of fuel control operation has contributed to reluctance to use the emergency fuel control system.

The F-105/J75 fuel control unit incorporates both the normal and emergency fuel control systems. During normal operation there are five signal inputs consisting of N-2 compressor speed, power lever angle (throttle position), burner can pressure, compressor inlet temperature and pressure. These signals are received by the normal (computing) side of the fuel control and, as a function of various servo positions, regulate fuel flow to the engine combustion chambers, relieving the pilot of responsibility for closely monitoring engine support instruments. The normal side of the fuel control also adjusts fuel flow for altitude changes for a given throttle setting, schedules fuel flow to protect the engine from overspeed, overtemperature conditions and compressor stalls during rapid acceleration and decelerations. As with all relatively sophisticated, close-tolerance mechanisms, the computing side of the fuel control is very susceptible to contamination and reacts in a manner that results in hung starts, unscheduled fuel flow shifts, lack of throttle response and overfueling. Hence, the emergency (preferably alternate) fuel control system. During operation in the emergency system, the normal side of the fuel control is inoperative and fuel flow is metered by the throttle valve which is mechanically linked to the throttle. Since the emergency system does not offer the automatic overspeed, overtemperature, flameout and compressor stall prevention features of the normal (computing) side of the fuel control, reasonable precaution should be exercised during throttle manipulation when operating in the emergency system.

The writer hesitates to comment on matters of a psychological nature; however, the impact of the word EMERGENCY may well be a major cause in creating reluctance toward use of this system. Possibly, if the systems were labelled NORMAL and ALTERNATE or AUTOMATIC and MANUAL, pilots of fighter aircraft would more readily use the secondary system.

There is one known condition causing slight fuel flow surges that should not be considered an abnormality. Pressurizing and dump valve discharge flow is unstable in the 3000 to 4000 pph flow range, as a result of secondary fuel cutting in and out. The exact fuel flow at which fluctuation occurs varies from one aircraft-engine combination to another. However, for a given installation fluctuation will occur only over a relatively small flow range, requiring only slight throttle movement for elimination.

Our story? In the unlikely event that unscheduled fuel flow shift, flameout, lack of throttle response or overfueling are experienced and selection of emergency fuel system results in normal engine operation, leave it there. The place for trouble shooting, investigation and evaluation is on terra firma or during special flight test programs. ★

Air Force Secretary Eugene M. Zuckert congratulates Maj William R. Wood, of the Military Air Transport Service for achieving a phenomenal individual safety record of 20,000 accident-free flying hours. Major Wood, who is assigned to MATS 1405th Aeromedical Transport Wing, Scott AFB, Ill., has flown more than 19 different types of aircraft without an accident since his first Air Force flight in 1942. General Howell M. Estes, Jr., (left), MATS Commander participated in the ceremony.

The PRECISION

Every pilot is familiar with the two types of precision approaches: Precision Approach Radar (PAR) and ILS. They are designed to enable a pilot to fly his aircraft to within close proximity of the runway and permit landing during minimal weather conditions. Since PAR provides an approach path for alignment and descent of an aircraft on final approach to a runway, exact guidance information is essential in both the vertical and horizontal planes. Basically, PAR serves the same purpose as an ILS, except the guidance information is presented to the pilot through aural instead of visual means.

The similarity between PAR and ILS does not end there. The PAR scope (military) has a logarithmic presentation which gives more expansion and supposedly more accuracy as the aircraft gets closer to the runway. The ILS does the same — increases in accuracy closer to the runway. For example, a one dot displacement of the glide slope indicator at one mile from touchdown represents approximately 100 feet above/below glide path! Our PAR indicators present the same accuracy on the scope as the ILS cross pointers do to the pilot in the cockpit.

We are now approaching the sole purpose of this article. What does accuracy mean to you as a pilot, instructor pilot, or stan/eval pilot? How would you use accurate information on a PAR approach? For example, suppose you were told, "150 FEET BELOW GLIDE PATH, ADJUST RATE OF DESCENT, FOUR MILES FROM TOUCHDOWN." Using this example, what adjustment would you make on the attitude gyro? What is your position in relation to the lower safe limit?

First, we will start with accuracy using the PAR indicator. The PAR controller can detect a plus or minus 20 feet deviation in the elevation scan. Immediately, we must throw out the 5, 10, and 15 feet deviations from glide path, especially when those deviations are more than one mile from touchdown. Azimuth deviations from the PAR "on course" can be recognized at approximately plus or minus 50 feet at best. Second, we will look at the ILS. Remember, a deviation the width of your ILS slope indicator needle at four miles would be approximately plus or minus 20 feet. A course deviation of one dot left or right at four miles from touchdown could place you at least 600 feet from the ILS "on course."

Flying the PAR final approach should be almost identical to the procedures for the ILS. Corrections for glide path and course deviations should become smaller as you near the runway. If you should receive a call of 200 feet above or below glide path at five miles from touchdown how would you make the correction to return to the glide slope? The instrument flying manual (AFM 51-37) does not give a quantitative answer. I think your corrections should be basically as stated on pages 8-3 and 8-4 in AFM 51-37. If you are 200 feet off the glide slope at five miles, your pitch attitude change should not exceed a 400 feet per minute vertical velocity change. I believe most pilots would have a tendency to overcorrect the first few times they receive a 200-foot deviation from glide slope. If a 200-foot deviation at five miles was called on a PAR approach, a pilot performing his annual instrument check would probably fail. On an ILS approach he would pass, even though the deviation from

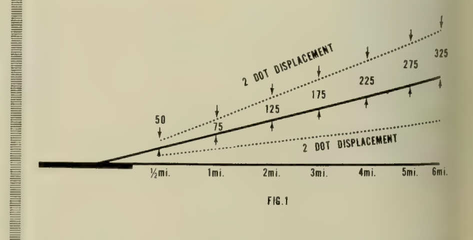
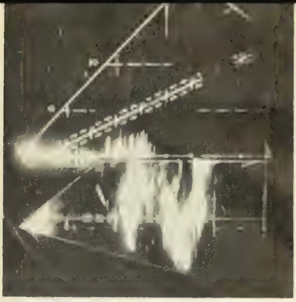


FIG. 1

Fig. 1 shows the two-dot displacement from ILS glide slope —these distances coincide with the PAR elevation safety zone limits. Fig. 2 shows one-dot azimuth displacement. Fig. 3 diagrams the PAR azimuth safety zone.

APPROACH



By Capt Bernard F. Albers, 1866 Facility Checking Flight, Scott AFB, Illinois

glide slope may be the same 200 feet at five miles. (Reference pages 33 and 43 of AFM 60-33 for an example.)

Look at this another way. You are three miles from touchdown on the front course of a good ILS system, your glide slope indicator is on the top dot in the ID-249. How far below glide slope are you? In addition, your course deviation indicator is one dot to the right. How far left of course are you? Answers can only be approximate; however, you are at least 150 feet below glide path and 500 feet left of course. Given this same position on a PAR approach you should have received "IF RUNWAY NOT IN SIGHT, CLIMB IMMEDIATELY AND MAINTAIN . . . " The missed approach instructions would be issued because you are at or have exceeded the PAR lower elevation limits and you are approaching the azimuth safety limits! Suppose this had been a check ride, executing an ILS you were within the grading limits; if on PAR you have exceeded vertical limits three times the allowable distance.

It is important that you, as a pilot, understand the information given to you during these precision approaches. First, we'll cover the PAR and ILS elevation information presentation. A two dot displacement on your ILS glide slope indicator will give the approximate deviations in feet from the glide slope as shown in Fig. 1. The two dot ILS deviations are the same as the PAR elevation safety zone limits. Second, the azimuth information with a 10,000-foot runway using a one dot displacement is approximately as shown in Fig. 2. The PAR azimuth safety zone is shown in Fig. 3. If you exceed the azimuth safety zone limits the radar controller must issue missed approach instructions.

Now as to *why* this article was written. This is the quickest way to tell you that our military air traffic controllers are trying to call deviations from *glide slope* and *on course* more accurately. As we approach the realization of this goal, we will be calling larger deviations more exactly, especially from glide slope. The larger deviations from glide slope, especially those over 50 feet, will require many changes in grading criteria by stan/eval personnel. The deviations will also require some changes in mental calculations by the pilot! Changes in aircraft pitch attitude should remain small.

Why should we change our present technique and insist on greater accuracy? First, it is not possible for a controller to accurately detect 5- and 10-foot deviations. More likely, such deviations range from 20 to 40 feet and should be called as such. Second, there are some pilots who fly aircraft with final approach speeds of about 200 knots. If they are to make the best use of a wet runway during low ceilings and visibility, a plus 25 feet at one half mile can mean up to 1500 feet less usable runway because of an extended touchdown point.

Third, accurate deviations given to the pilot beyond three miles from touchdown will better enable him to determine the best rate of descent in order for him to maintain the glide slope.

This review and analysis of the precision approach and improvement in our technique is one of the continuing steps taken by AFCS to improve the service to you, the users. ★

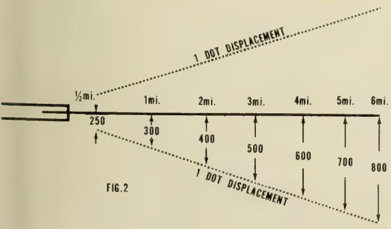


FIG. 2

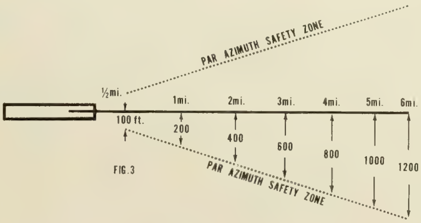


FIG. 3

MISSILE
SAFETY AWARDS

Missile Safety Plaques have been awarded to the following Air Force organizations for outstanding safety achievement during 1964.

ADC	• 1 Fighter Wing, Selfridge AFB, Michigan
	• 46 Air Defense Missile Squadron, McGuire AFB, New Jersey
AFSC	• 6595 Aerospace Test Wing, Vandenberg AFB, California
PACAF	• 41 Air Division, APO San Francisco 96328
	• 18 Tactical Fighter Wing, APO San Francisco 96239
SAC	• 351 Strategic Missile Wing, Whiteman AFB, Missouri
	• 308 Strategic Missile Wing, Little Rock AFB, Arkansas
TAC	• 4510 Combat Crew Training Wing, Luke AFB, Arizona
	• 4520 Combat Crew Training Wing, Nellis AFB, Nevada
USAFE	• 38 Tactical Missile Wing, APO New York 09130
	• 49 Tactical Fighter Wing, APO New York 09123
ANG	• 148 Fighter Group, Duluth Intl Airport, Duluth, Minnesota

Missilanea

MY ACHING RAIL — In this time and age if you have an aching back, you are among the elite. However, with aching rails you just have trouble, as recently experienced by an F-101 armament crew in the process of downloading an AIM-4C. As the launcher rails were extended, the aft fitting assembly P/N 33-73652-1, on the left-hand outboard launcher broke. This caused the rear end of the launcher rail to drop and the forward portion to rise. The nose of the missile struck the aircraft. The infrared dome of the guidance unit was cracked and the leading edge of a fin was dented. Inspection of the broken aft fitting assembly revealed that part of the assembly was missing. This caused an overstress on the remainder of the assembly.

Suspected Cause Factor: The launcher rail that failed had recently been frequently extended with WSEMS aboard during high-speed flight.

Action: An inspection is presently being made of all launcher fitting assemblies within this squadron. As man and equipment age, both require frequent and closer inspection. With equipment, technical orders and checklists provide the frequency; *you* the Doctor must provide the thoroughness.

Just think what an aching back the airplane would have had if this rail became loose in the slipstream!

Lt Col M. L. Chardi
Directorate of Aerospace Safety

TECH DATA — AGAIN! The AFTO 22 system, tech data conferences, and the applied interest of many individuals have gone a long way toward improving the quality of missile weapon system tech data. But, regardless of its degree of perfection, the tech data cannot serve us if we don't use it properly.

Recently, a team of contractor and depot maintenance personnel was connecting a rather expensive piece of missile guidance equipment to a power source at a missile site. Power was necessary to provide heat while the unit was removed from the missile. Although this was not a normal or usual maintenance task for them, none of the team members had thought to bring along the applicable tech data. Instead, they called back to the contractor's office at the base for guidance. In relaying instructions over the telephone something was lost, consequently the connection was improperly made. The work was done in the presence of both the job supervisor and a maintenance inspector and signed off. Less than three hours later, it was found that the guidance unit had been severely damaged.

Constant admonition on the use of Tech Data had either failed to reach the right people or had fallen on deaf ears. This incident proves again, if such proof is necessary, that maintenance people, whether they are "blue suiters," depot, or contractor personnel, must have tech data available, be familiar with the procedures to be followed, and follow them to the letter. Nothing less is acceptable.

Major K. H. Hinchman
Directorate of Aerospace Safety

ATLAS-TITAN DEACTIVATION. The fact that missiles have been removed and are now in storage, and the fact that the cryogenics have been offloaded or boiled off does not mean that the silo is now safe and that safety precautions are unnecessary.

We must continue to apply sound safety practice. Every supervisor must understand that safety is still an important aspect of his job of silo maintenance. Some of his people may not be missile trained or silo familiar. Yet, these people will perform required maintenance and monitor silo preservation. Those concerned with now empty silos must become intimately acquainted with the "hole in the ground," locate the pitfalls, and establish procedures for entry that leave no doubt as to the safe way.

Possible areas of attention could be residual gases, diesel fuels, gases under pressure for diesel starts, deterioration of still used electrical connections, elevators that are not used daily, atmospherics in areas not entered on a daily basis, emergency exiting in event of power loss while in the empty silo, protruding metal after equipment removal, sewer gases from latrines that are not being used or from sumps that are not being drained, etc. The list may be lengthy and cover items not contained in existing technical data.

Even though major hazards have been removed from the silos, subtle pitfalls may remain which, combined with personnel not familiar with the new configuration of the silo, can breed accidents. ★

Lt Col C. N. Mozley
Directorate of Aerospace Safety

System Safety—a dramatic new concept that grew out of Air Force mishap experience—will drastically change the course of system management both for the Air Force and its contractors. The author explains the need for, and the principles of, this new concept, AEROSPACE SAFETY recommends the article for reading by Air Force personnel at all levels.

SYSTEM SAFETY

By W. L. Irvine, Ballistic Systems Division, AFSC, Norton AFB

In December 1960, at Vandenberg AFB, a low order explosion (or deflagration) and fire completely destroyed a $45 million missile launch test site. The cause of this disaster was a relatively small component of the missile system: the hydraulic control valve on the missile elevator system failed, primarily because it was not strong enough to do the job expected of it.

The contractors concerned had some doubts about these valves, since there had been minor troubles with them previously, so they had worked out a correction which involved increasing the weight of the elevator counterweights. However, because it would take nine days to acquire and install the additional weights, the decision was made to go ahead with a scheduled test operation. This was a trade-off between safety and time — and obviously the wrong decision was made.

The forces involved in this catastrophe can be judged by the fact that the entire crib structure inside the silo was blown entirely free of the silo. Perhaps even more impressive: A forty-ton piece of equipment was found 1200 feet away from the missile installation.

In another accident, the leaf of a silo closure door, which weighs more than 100 tons, fell while undergoing operational tests. The cause was again a hydraulic valve. Investigation showed that the piston in the valve had not been built in accordance with the approved plan.

During the past several years considerable publicity has attended accidents in which four Atlas F launch facilities were destroyed. In each case the loss of these facilities was due to the failure of relatively small components within the total system.

The accidents described might indicate our interest is only in the prevention of catastrophic events. This must not be the case; we are concerned with all items affecting safety.

There are many locations in missile installations where high pressure tubing has been installed with little or no protection. In one case, an unprotected 2500 psi line terminates adjacent to a door frequently used by personnel.

But the real classic of all the minor design deficiencies which have come to our attention was a combination safety shower and eyewash at a northern missile site. In order to operate the eyewash, a man, who might already be blinded by acid, had to put his head in the eyewash bowl and then turn the water valve on with his right foot. The only problem was that the foot-operated valve was about four feet to his rear and higher than his waist. As an additional feature, if a man did happen to hit the valve, he got a full shower from overhead as well as getting his eyes washed out. However, the problem became academic in winter because the whole system froze.

These few examples illustrate the need for a new safety concept. Such a concept is now in existence; it is known as *System Safety*.

DEFINITIONS

Because of the many factors to be considered, any definition of system safety is complicated, therefore considerable explanation is required along with a bare definition. Basically system safety can be said to be "the use of management, scientific and engineering criteria, principles and techniques in all applicable disciplines throughout all phases of system development to secure the highest possible degree of safety within the constraints of time, cost and operational effectiveness."

Now for those explanations: The primary objective of system safety is to reduce the hazardous consequences of equipment operation. It involves the systematic use of analytical techniques, scientific data, design criteria, engineering principles, evaluation procedures, management skills, and experience reporting and recording systems. Because the goal of system safety is prevention rather than correction, particular attention is given to early engineering design and procedural analysis.

Basically, the following four statements summarize system safety as a discipline:

1. System safety is a distinct technical management discipline with its particular and unique body of specialized knowledge.
2. System safety is an integral and deliberate design objective of the Air Force, which cannot be left to chance or benevolent research and development.
3. System safety is a blanket discipline touching on many related fields and, within its own frame of reference, transcending all of them.
4. System safety is a coordinate discipline at all levels of technical effort requiring continual trade-offs between hazard elimination and optimal mission support or effectiveness.

Now let's discuss the why and how of system safety. In the past, system safety was procured as an inherent consideration in each contract, and no contractor ever deliberately designed an unsafe system. But no place, either in the Air Force or the contractor's organization, was there any system or method to insure that safety was considered throughout the development phase.

SAFETY MIL SPEC

In order to correct this weakness, the Ballistic Systems Division, AFSC, prepared BSD Exhibit 62-41 in April 1962. It has since been revised, the last time in July 1963. During this period the Directorate of Aerospace Safety, DTIG, observed the operation of the systems safety engineering principles contained in BSD Exhibit 62-41. Approving these actions, they undertook to write a military specification to make the practice Air Force-wide. From their draft finally emerged Military Specification MIL-S 38130 published 30 September 1963. It provides safety inputs in development of all new Air Force systems.

The title of MIL-S 38130 is "General Requirements for Safety Engineering of Systems and Associated Subsystems and Equipment." The stated purpose is "to achieve a comprehensive system safety engineering effort, integrated with the system design, development, manufacture, test, checkout, and, as applicable, construction/installation/activation/operational efforts." The means to accomplish are specified: "establish and pursue an active system safety engineering plan for the systems and associated subsystems and equipment." This means that the System Safety Engineering Plan (SSEP) is the important basic document which will be used throughout systems development.

The plan is acquired by informing the contractor in the Request for Proposal that he must provide a preliminary system safety engineering plan as part of his proposal. This preliminary plan will be considered with all other items in making the contract award.

Each associate contractor will have a system safety engineering plan for his subsystem and the integrating contractor will have a system safety engineering plan to cover the entire system.

When completed the plan will include, first, responsibility. It will identify within the contractor's organization the focal point for his safety engineerng efforts. It will detail the functions of this group, the authority they have within the company, and their interrelationships with other departments.

A second section will detail the program sequence. This will include milestones for planning, design, test programs, and operation.

A third section will list safety requirements and design criteria which will be used in system development.

A fourth section encompasses some of the most important activities to be detailed under the system safety engineering plan. These are subsystems safety analyses.

SUBSYSTEMS COVERED

First, we will cover those to be performed by the associate and/or subcontractors. These analyses will define and identify hazards. Failure mode and malfunction effects analyses will be made and hazards will be identified according to a four part code. These safety hazard classifications are:

SAFE	which means that mechanical failure or personnel error cannot result in damage or injury.
MARGINAL	which means that mechanical failure or personnel error will degrade the system but can be counteracted without damage or injury.
CRITICAL	which means that mechanical failure or personnel error will degrade the system and result in abort, damage or injury.
CATASTROPHIC	which means that mechanical failure or personnel error will cause permanent damage and severe injury.

Another section of the system safety engineering plan will describe procedures for post-analysis actions. These will tell how catastrophic hazards will be eliminated and how critical hazards will be minimized. Four guides are provided for this purpose. The first is to design for minimum hazard. This is the best, most practical and cheapest method. Where the best possible design cannot minimize the hazard, safety devices may be provided which will prevent damage or injury. The third guide is to install warning devices — lights and bells and other signals to indicate when a hazard exists. Finally there are special operating procedures. This is obviously the weakest method because it places dependence on people doing what they are supposed to do when they are supposed to do it.

In addition to the subsystem analyses, system safety engineering analyses will be required from the prime integrating contractors. These will include systems integration analyses which will define interfaces and identify problem areas. These must be continuously kept up-to-date as subsystems may be changed in the course of development. System failure mode analyses will be made of the entire system. This will define all possible modes of failure including the effects of personnel error. Operational safety analyses will be made. These will determine safety requirements of personnel, procedures and equipment to be used during maintenance, support, testing and training. From the operational analyses, emergency backout procedures will be developed to assure safe egress, safe escape routes, and rescue procedures.

ELIMINATES DUPLICATE EFFORTS

MIL-S 38130 also requires that prime, associate, and subcontractors will not duplicate efforts, tasks, analyses, etc. Joint proposals must contain the action agencies for the various tasks and those portions of the specification to be applied to subcontractors. In particular, systems safety efforts defined in other contract requirements will not be charged against this specification. Of course, any deviations from the approved plan must be agreed to by the procuring agency, and MIL-S 38130 may be applied to modernization and updating programs as well as complete system development programs.

The implementation of MIL-S 38130 obviously depends to a great extent on the contractor's safety engineering organization. The safety program director must have access to top level supervision within his company, and he must be continuously informed of all actions taken or proposed. Many of the largest aerospace development firms have completely reorganized their safety engineering staffs to carry out these principles.

USAF RESPONSIBILITIES

Of equal importance to the contractor is the safety organization within the Air Force procuring agency. The System Program Division of AFSC and the System Support AMA must have adequately manned safety offices to assure that system safety engineering efforts performed by the contractor are not lost within the Air Force itself. This could happen due to Configuration Control Board (CCB) actions or contract changes not coordinated through safety engineering. The Air Force safety offices must exchange information with all project officers in the organization, e.g., quality control, reliability, tech data, ordnance, test nuclear safety, and CCB's.

One of the most important functions of a SPO safety office is to organize and chair a System Safety Group (SSG) in accordance with AFR 58-4. Membership of the SSG may include representatives of the staff safety office of the development organization, site activation task force (SATAF), the Directorate of Aerospace Safety, the AMA concerned, the using command, technical development contractors and, of course, the associate and integrating contractors.

Tasks of the SSG include:

- Review safety specifications and requirements;
- Exercise surveillance over all safety activities at test and operational sites; design criteria, functions and interfaces; hazard and catastrophe analyses;
- Act as advisor to engineering groups and boards;
- Recommend to the CCB safety priority on proposed or actual changes. SSG's will be continued throughout the life of the system by the Logistics Command AMA.

Whenever a program involves nuclear components, the System Program Director should designate a nuclear safety officer within the safety office. This officer will insure that all the weapon system contractors are aware of the DOD nuclear safety standards defined in AFR 122-2 as well as other pertinent nuclear safety documents. He will also insure that basic design safety principles, such as isolation of energy sources and fail/safe components, are recognized and incorporated in the weapon system. Nuclear safety analyses to insure maximum design safety should be performed at frequent intervals throughout the design phase.

System safety has become a rapidly developing field. A recent development is a requirement from General Bernard A. Schriever, Commander, AFSC, to produce a system safety management manual. This manual will specifically define the system safety effort associated with the Systems Command administered mainstream effort during the program conceptual, definition and acquisition phases of the system life cycle. In addition, the task force established by General Schriever will revise and update MIL-S 38130 to relate more closely with the procedures in AFSCM's 375-1, 375-4, 375-5 and 310-1.

In summary, system safety is relatively new and is becoming increasingly important in the development of Air Force systems. The few examples cited in this article demonstrate why system safety is necessary and various regulations, specifications, manuals, and exhibits exist or are being prepared that will implement system safety into all Air Force systems. ★

Simply Pull The Ring And . . . .

By SSgt Robert E. Brock, USAF-Ret., PE Section, Norton AFB

The new J-1 parachute release is basically the same as the old model all aircrews are familiar with, except that a loop of cable replaces the pushbuttons. Users cussed and discussed the old model because it was often difficult to release. This was particularly true when the user was wearing gloves, wasn't wearing gloves (in cold weather), was confused, or just not very sure about the operation of the mechanism.

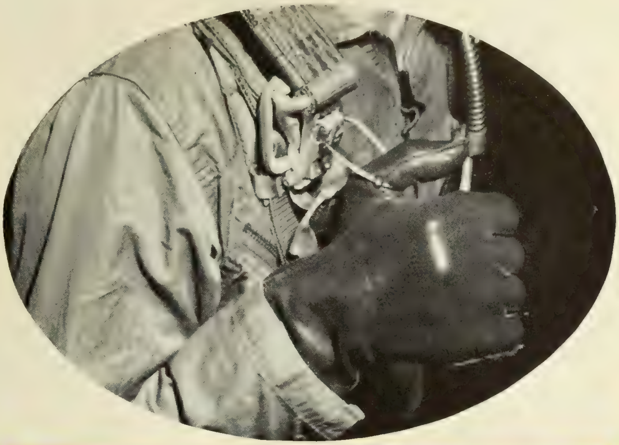
Now before the cussing gets too strong about the new release: You may find it hard to operate. It was designed to operate very simply—just reach up and pull the safety cover down, then slip one or two fingers in the loop and pull. So you pull and nothing happens. What next? Panic?

If the release doesn't open on the first pull, and it may not, pull again, sharply. If it still doesn't open, reach over with the other hand, hook a couple more fingers in the ring and pull again—hard.

Chances are yours will work all right. But a few will require a good healthy jerk. Don't be dainty. PULL!

The reason for this is the newness of the equipment. The releases we've found most difficult to operate are on the newly manufactured chest type harness, but it's the same release that is on other types. Personal Equipment people are using a lubricant and working the releases during each routine inspection in an effort to wear off the newness so that the equipment will work easily when you need it most.

Suggestion: If you haven't received training in how to use the quick release, visit your PE shop. It's much better to learn how to unstick one here than to struggle with a sticky release while being dragged through cactus by a 25-knot wind. ★



J-1 parachute release is designed for one-finger operation. Just pull down the guard, grab cable with one finger, and pull.

Some releases may be hard to pull. Don't wait. Use both hands, and jerk hard!

New release is simple and quick. Nevertheless, why not visit the PE shop and have the fellas give you a thorough briefing, then try it a few times yourself.

IT CAN HAPPEN to YOU

By Maj William T. Smith Directorate of Aerospace Safety

Be honest now, are *you* one of those people who believes accidents happen to the other guys? Don't be afraid to speak up. I'm sure you are not alone. I believed this for a long time. In fact, I believed it up until my present assignment. I know better now; accidents can happen to me—or you!

I had been in the Directorate of Aerospace Safety but a short time when I saw the light. I am one of those responsible for reviewing many of the aircraft accident reports that arrive daily. Even though I now have "religion," I am appalled at the number and many types of accidents and incidents that occur. The ways in which accidents occur are literally beyond my imagination.

But, threaded through many of these reports, is a common condition. Much of the time those involved failed to adequately cope with unusual situations. And the recommendations to prevent recurrence can generally be resolved to one basic essential—pilots and other aircrewmen must mentally condition themselves to the idea that an emergency *can* happen to them. Then, with this mental stimulus, if they learn the SOP's for normal situations, they will be better able to handle the emergencies.

Now, let's consider panic. There is no doubt that panic is an important factor during an emergency. Consider the pilot's attitude during a check ride. There we anticipate practice emergencies and concentrate on procedures knowing full well that we are in a simulated situation and no great hazard exists. All effort is directed toward handling the emergency promptly and effectively. But during a real emergency, panic or anxiety might reach a level where judgment is impaired and the pilot's response to the situation is imprudent. It is not possible to predict a pilot's reaction to an actual inflight emergency. However, thorough training and self discipline tend to have a leveling influence on our actions at such times. If every pilot, as he lined up on the active, anticipated an emergency condition on takeoff, he would be mentally conditioned and alert, and certainly more capable of handling the situation. For example, if I lose No. 4 engine on liftoff, what will I do? Have I briefed the copilot and engineer adequately to preclude confusion and panic in the cockpit when time is precious? At the risk of being redundant, the point being emphasized is that it is necessary for pilots to recognize the possibility of an emergency occurring during any phase of flight.

The aircraft Dash One describes procedures for handling most of the emergencies that can reasonably be expected to occur. But it is impractical to write this handbook to cover every conceivable malfunction that may occur and which may be complicated by failure of other systems or subsystems. Furthermore, it would be impossible to commit to memory all the procedures considered necessary to handle these emergencies. However, knowledge of the fundamental emergency procedures and a comprehension of how the aircraft's basic systems operate should provide the pilot with the information necessary to make intelligent decisions in coping with most emergencies.

There are many methods of improving pilot proficiency and knowledge of emergency procedures. Here are some training aids I have observed.

- Place typewritten Dash One bold face items prominently inside of latrine doors with a plain cover sheet listing the type of emergency.
- Discuss an emergency-for-the-

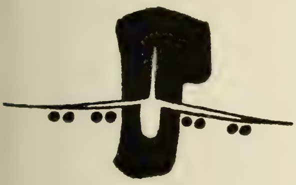
day at mission briefings or scheduling meetings.

- Display bold face items on a bulletin board in the briefing room.
- Hand out questions on aircraft emergency procedures at monthly flying safety meetings.

These suggestions should help provide some of the motivation essential to a successful safety program.

One of the unfortunate facts about safety is that it is not self-perpetuating. On the contrary, experience indicates that organizations with good safety records frequently tend to take things for granted. They become *complacent* (there's that word again) and accidents occur.

As examples of the types of situations of which I speak, here are a few of the more unusual accidents and incidents which have occurred in recent months. Read on and you will see why we, in Flight Safety, are justifiably appalled by some of these. As an incentive you might ask yourself what would *you* have done under the same circumstances.



While on a GCA approach with an ILS backup, the pilot of a B-52 crossed the threshold at 50 feet and 138 KIAS. Best flare speed was computed to be 131 knots. The pilot queried the copilot on whether they could land OK and received a conditional affirmative reply "yes, if the aircraft is landed immediately." After the aircraft had floated approximately 4000 feet, the pilot applied power for a go-around. The co-pilot, thinking that the pilot was reaching for the air brakes, deployed the drag chute and the aircraft contacted the runway at the 7000-foot marker and bounced. During the ensuing confusion, the pilot chopped the throttles but the copilot, thinking they were still on the go-around, simultaneously jettisoned the drag chute. The aircraft finally came to rest well beyond the overrun. Fortunately no one was injured and the aircraft drop tank and pod suffered only superficial damage. However, a ruptured fuel cell could have resulted in a fire with extensive damage and loss of life. We know that pilots occasionally find themselves in a compromising or unforgiving situation such as this with excessive air speed on final approach; however, proper crew coordination and pre-established and understood procedures probably could have prevented this incident.

A flight of B-57's had just completed a mission and returned to home base. Two aircraft broke off from the lead element and contacted GCA for a series of practice approaches. On the second approach the wingman noticed a strange odor in the cockpit which he thought to be alcohol or ether. Although he was on 100 per cent oxygen at the time, this pilot detected the odor because his mask was leaking around the bridge of his nose. Two GCA's were completed successfully and the flight leader called for a channel change to tower frequency. Traffic pattern entry and the break were normal. The pungent odor was still apparent so the pilot tightened his mask and made a long base leg. He stated that gear and flap extension seemed extremely slow. A gear check was called on the final, but jet wash from the lead aircraft precluded continuation of the approach so a go-around was initiated.

The aircraft was cleaned up and the pilot noted at this time that his breathing was labored and his side vision was gone. He also experienced a skin-tingling sensation. On the second approach, the pilot does not recall extending the gear, but at this point the oxygen mask was rechecked and pressure oxygen selected. An improvement in vision was noted on final and the landing was accomplished without further incident. After turning off the active, the pilot stopped the aircraft, climbed out and immediately experienced the dry heaves. It is doubtful if this pilot could have made a successful landing if another go-around had been necessary. Moreover, if pressure oxygen had not been selected he would probably have lost consciousness. The preliminary stages of an individual approaching unconsciousness were already evident, e.g., seeing stars, grogginess and weak feeling. After a few minutes of breathing 100 per cent oxygen at the hospital the pilot stated he felt normal. A thorough examination of the cockpit revealed a leaking hand fire extinguisher (CB type).

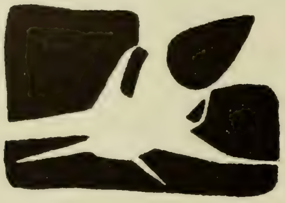
Due to continued emphasis by responsible personnel, disparities in manifested weights and actual weights are relatively infrequent, but they still occur. Therefore, those flying transport type aircraft should continue to take a skeptical look at cargo weights and the calculated aircraft CG before each flight. The extremes in this area were realized recently during a major airlift operation.

The means of weighing vehicles was not available prior to air shipment so the shippers estimated the weights, and, where a doubt existed, weights were padded by an amount which was considered adequate beyond a doubt. Unfortunately, these people were not aware of the fact that errors of this type could create serious aircraft weight and balance problems.

Errors in overestimating the weights varied up to approximately 235 lbs—which in itself is not too significant, but, conversely, a serious situation occurred when the weight on one vehicle was underestimated by 24,230 lbs. Admittedly, the 24,230 lbs is the extreme case but errors of 3000 to 4000 lbs were quite common with several in the 13,000 to 17,000 lbs category.

Administrative action has been taken to preclude recurrence of this type error but it's the old story of Murphy's Law, and no amount of paperwork can prevent all stupidity or carelessness. You as Aircraft Commander are responsible for all factors which affect safety of flight so to quote our friend the flight surgeon, "watch your weight!"

A flight of F-4C aircraft was on a cross country at FL 340. While circumnavigating a thunderstorm, the flight passed between two cells and a lightning bolt passed horizontally beneath the lead aircraft. Almost immediately Nr 2 aircraft experienced a flameout of the left engine and simultaneously Nr 3 aircraft a flameout of the right engine. Both pilots were successful at airstarts and the aircraft continued on to their home base. No damage was sustained by either aircraft. It is suspected that the lightning caused atmospheric phenomena that temporarily interrupted airflow to the outboard engines of the wingmen in the flight. Although an effort was made to stay clear of the thunderstorm, the route of flight necessitated flying in close proximity to some cells resulting in a temporary emergency. Unless military necessity dictates otherwise, the 180-degree turn is still recommended as the best accident preventive action by pilots encountering thunderstorm activity.



These examples should serve to illustrate the diversified and unusual types of incidents occurring daily. Any one of them could have resulted in a fatality. We in Flight Safety hope that a fatal accident in your squadron isn't the type of motivation that you as a crewmember require to be safety conscious.

Knowing that it *can* happen to you should serve as an incentive to see that it doesn't." ★

TO ERR IS HUMAN

By Col James F. Risher, Jr., Chief, Ground Safety Division

Pilots with thousands of hours in the air have landed with gear neatly retracted. Mechanics, crew chiefs, missile technicians, all have committed errors that belied their training and the checklists that were available to them. Young fighter pilots, men capable of hacking a 200 foot ceiling in the world's fastest and most sophisticated aircraft, have "lost control" of their sports cars on the highway and "failed to negotiate the curve." Welders and machinists have lost eyes and fingers after years of skillful job performance by simply neglecting to use protective devices. Such illustrations of puzzling human errors could become an endless list.

We must remember that the people who made these mistakes, ludicrous or tragic, depending upon the results, performed these or similar acts the correct way many, many times. Here we can take note in passing of a famous line, Murphy's Law, that "if it can happen, it will happen."

For us in the safety business, the more commonplace error assumes prime significance. There is no assured correlation between degree of error and magnitude of consequences. In our times, some of man's errors of action and reaction result only in momentary embarrassment, while others of similar nature have far more serious consequences. Simple human actions—flipping the wrong switch, missing one item on a printed page—may result in no more than "OOPS!" and correction of error in some situations, or a multi-million dollar accident in others.

Furthermore, while man's capacity for error has not increased, his opportunity has increased astronomically in our mechanized times. Even more significant is the fact that our present day environment provides penalties for mistakes which simply did not exist until recent times. Not too many years ago it would have been literally impossible for a maintenance technician on the flight line to strike from the Air Force's and the nation's assets some $8,000,000 by a single act of human error. Yet this was done when one item was omitted in a tech order procedure and a strategic bomber was destroyed by fire on the ground. Normally, a moment of hesitation or indecision should not incur a significant penalty. Yet for the fighter pilot faced with a decision on ejection from his crippled aircraft, this may be the moment, the single second, that costs his life. Then there is the faulty valve, the washer, the small connecting device, far back and obscure in the aircraft or missile which may be the subject of an Unsatisfactory Report, or the cause of a catastrophic accident. For it was not until recent times that engineers, designers, and manufacturers could, through faulty design or omission, breed system deficiencies in weapons and machines which, though obscure and small in themselves, may have colossal effects in costs of corrective action, or even more, accident potential.

Whether we think of the missile technician readying a space shot, the pilot of a modern jet transport, the aircraft maintenance specialist working over multi-million dollar equipment, the designer or engineer over the drawing board or in the test chamber, or even the average driver behind 300 horsepower on the freeway, we are thinking of

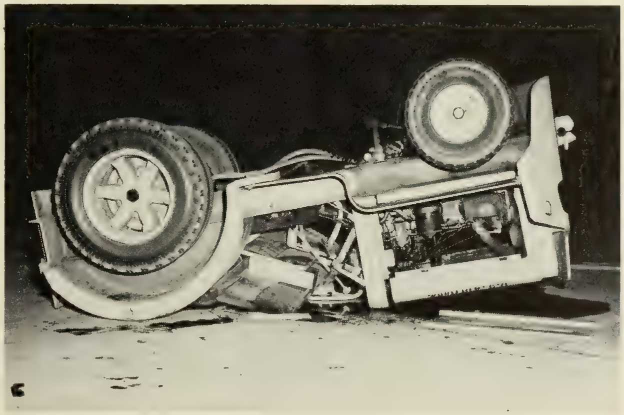
people who have enormous potential for costly and tragic human error. Conversely, we are thinking of people who can and do make their individual contributions to our complicated, highly intricate way of life by efficient, enlightened, safe performce of their normal tasks, day after day.

We safety people like the routine day. We abhor the wail of sirens. We hate accident investigations. We prefer incidents to accidents and little accidents to big ones. So we press on, as best we can, toward our twofold goal: First, reduction of the probability of human error and, second, reduction or elimination of harmful results when errors occur.

The tools of our safety trade are many and varied. They change to suit the time and the need. New ones come and old ones go, or are reshaped. But all are designed to lessen the error factor, increase the forgiveness factor, or both. Standard operating procedures; checklists; protective devices and clothing (seat belts, helmets, flying gear); survival equipment; warning signs; personnel screening, mental and physical tests; evaluation; surveys; control and supervision of work areas; safety distances; design criteria and specifications; training; management; motivation; —these are a few of our tools.

Our title is, of course, the first part of a classic sentence which has been quoted throughout the civilized world for decades past. If we are ever called upon to justify our programs and our tools in the fewest possible words, perhaps we, too, should borrow Victor's Hugo's time-burnished line and say simply "TO ERR IS HUMAN, TO FORGIVE DIVINE." ★

". . . while man's capability for error has not increased, his opportunity has increased astronomically in our mechanized times."



THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. **If I am flying a B-52 at the emergency safe altitude on the FLIP Terminal Chart (8000 feet) and Approach Control clears me to the outer marker to *hold*, would I use one minute legs as FLIP, Section II says, or one-and-a-half minute legs as AFM 51-37 says? Would I be doing a procedure turn or a holding entry? *(Captain Art Laehr, Glasgow AFB, Montana.)***

A. One minute legs. You will be flying a holding entry. AFM 51-37 contains instructions for accomplishing *procedure turns* which are maneuvers completely separate and distinct from holding pattern procedures. It does not contain instructions for holding. If Approach Control cleared you to the outer marker to *hold*, you would fly the holding pattern in accordance with the procedures outlined in FLIP, Section II.

POINT TO PONDER

Here is a good method to determine a heading to fly when proceeding direct from one DME fix to another. This procedure can be of real value when administering flight checks, flying on instrument proficiency flights, or when cleared by ATC to proceed direct from one DME fix to another. We'll start by drawing a diagram showing a simple situation (Fig. 1). Assume that you are 40 miles south of the TACAN station and wish to go to the 20 NM DME fix on the 090 radial. If we draw our diagram to the proper proportions, it's fairly simple to see by "eye-balling" that the no-wind heading to the fix will be about 030°.

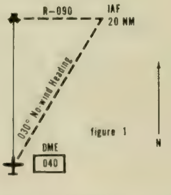


figure 1

The procedure we are going to suggest is nothing more than mentally drawing a diagram such as this on any compass card in the cockpit.

When you draw the diagram, there are three rules to keep in mind:

1. The center of the compass card will represent the TACAN station.
2. The greater the two distances (your range or the fix distance) will be represented by the outer edge of the compass card.
3. Your aircraft position will be somewhere along the line from the center of the card and the tail of the bearing pointer. (Opposite the head if the bearing pointer has no tail.)

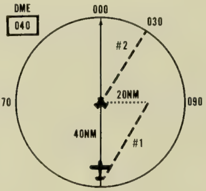


figure 2

Now, look at figure 2 and we will see how this works using the same problem as above. The greater of the distances is your range (40 miles), so the compass card will be 40 miles in *radius*. Your aircraft position is at the tail of the bearing pointer. Now, find the desired radial (090) and go out that line 20 miles from the station (halfway from center). Line 1 represents your flight path to the DME fix. To find what the no-wind heading will be, you simply slide this line parallel so that it passes through the center of the compass card (line Nr 2). You then read your no-wind heading to the fix where line Nr 2 intersects the edge of the compass card (030°).

If both distances are equal, you use the same procedure, except that both distances are represented by the edge of the compass card. The final situation you could encounter is when your range is less than the DME fix distance. The procedure remains the same, but now the radius of the compass card will be equal to the DME fix distance, and the proportions must be reversed. This is shown in figure 3.

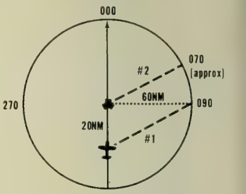


figure 3

In this situation you are 20 miles south of the TACAN station and wish to go to the 60 NM DME fix on the 090 Radial. Since the radius of the card is 60 miles, you find your aircraft position 20 miles from the station (one-third of the way out from the center of the card) Line Nr 1 is again your flight path and line Nr 2 is the parallel line to find the no-wind heading.

There is one final capability of the procedure that should be pointed out. Since you have se your diagram up to proportion, you can also find your approximate distance to the fix. For example, in figure Nr 2, the radius of the compass card is 40 miles. Your fligh path line (line Nr 1) is slightly longer than the radius of the card Therefore, you can see that your distance to the fix is approximately 45 miles.

Clearances to proceed direct to a DME fix are becoming more of an everyday occurrence. Being able to use this procedure can save you and the controller time and trouble. Remember, radar is not always available. We suggest that you spen some time in the simulator or on a practice ride using this method Perhaps you can increase your capability as an instrument pilot. ★

FAA

ADVISORIES

ob Terneuzen
Liaison Officer
ctorate of Aerospace Safety

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS). The Federal Aviation Agency conducted operational tests at San Francisco, Chicago O'Hare and New York Kennedy Airports to determine the feasibility of automatically broadcasting routine non-control information in the terminal area. The tests concluded that ATIS provided relief to the problem of frequency channel congestion, provided the controller more time for solving traffic problems and permitted the pilot to obtain the information at times when cockpit duties were least pressing and to listen to as many repeat broadcasts as he might desire.

ATIS is the continuous broadcast of recorded non-control information in high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.

ATIS messages contain routine information such as ceiling, visibility, wind, altimeter setting, instrument approach and runways in use, and an identifying code word.

Example: "THIS IS WASHINGTON NATIONAL AIRPORT INFORMATION BRAVO. CEILING MEASURED TWO THOUSAND, OVERCAST, VISIBILITY SIX, SMOKE. WIND ONE SIX ZERO DEGREES AT FIVE. ALTIMETER TWO NINER NINER TWO. VOR RUNWAY ONE FIVE APPROACH IN USE. LANDING RUNWAY ONE EIGHT. DEPARTURES ON RUNWAY ONE FIVE. NOTAM, GEORGETOWN RADIO BEACON OUT OF SERVICE UNTIL FURTHER NOTICE. INFORM WASHINGTON APPROACH OR GROUND CONTROL ON INITIAL CONTACT THAT YOU HAVE RECEIVED INFORMATION BRAVO."

Messages are automatically broadcast on the voice channel of a TVOR/VOR/VORTAC located on or near the airport, or on a discrete VHF control tower frequency. The messages are updated as necessary to keep the information current and will normally not exceed 30 seconds in length.

Pilots hearing the broadcast inform the tower or approach controller on initial contact that they have received the information by repeating the code word appended to the message, thus obviating the need for the terminal controller to issue the information. Example: ". . . I HAVE RECEIVED INFORMATION BRAVO."

Terminal controllers issue pertinent information to pilots who do not acknowledge receipt of the ATIS message or who acknowledge receipt by a code word which differs from that assigned to the current message.

Each ATIS message will be identified by a specific phonetic code. The first recording of each day will be coded ALPHA. Subsequent updated messages will be assigned succeeding alphabet codes (BRAVO, CHARLIE, etc.); thus, the same alphabet code will not be used again until all code letters in the alphabet have been used sequentially.

A new recording will be made when there is a:

a. Regular hourly weather report issued that differs from the previous broadcast.
b. Special weather report issued.
c. Change in the type of instrument approach.
d. Change in takeoff or landing runways.
e. Change in other information of the previous broadcast.

IMPLEMENTATION — Initially, ATIS is being established at the following FAA tower airports:

Boston
New York Kennedy
Washington National
Atlanta
Miami
Houston
Dallas Love Field
Kansas City Municipal
St. Louis
Chicago O'Hare
Denver
Van Nuys
Los Angeles
San Francisco

A national program has been developed to provide ATIS at approximately 60 locations by the end of 1965.

A listing of locations currently providing ATIS, hours of operation and frequencies of voice outlets is contained in the Airman's Information Manual.

PILOT PARTICIPATION — The success and effectiveness of ATIS is largely dependent upon cooperation and participation of airspace users. Although participation is voluntary, pilots are urged to cooperate in the ATIS program since it relieves frequency congestion on approach control, ground control and local control channels. ★

Aerobits

TAXIDENT—What happened can be told very simply: A T-39 with an IP in the left seat taxied into an MD-3 power unit. The MD-3 being the more durable, the aircraft wing received a tear about four inches deep. Cost to fix was estimated at 50 manhours. The causes were routine for this type incident: the pilot wasn't using wingwalkers and there was supervisory error in that the power unit had not been moved to a safe place, and a newly-assigned airman directing the taxi operation was inadequately supervised.

For the next chapter of this never-ending story, see Aerobits next month.

AIRSPEED DROP—C-135. After completing a training mission the TACAN holding pattern was entered at 25,000 feet. As the first pattern was completed and while the aircraft was in cirrus clouds the copilot's airspeed dropped from 242 to 205 knots. Pitot heat switch was on and circuit breakers were in. Copilot's airspeed remained 37-40 knots below pilot's. By using charts and groundspeed checks with TACAN and airborne radar, the crew determined the pilot's airspeed indicator to be most accurate. With a 500-foot ceiling, the decision was made to divert from the midwest base to an east coast base with better weather. Nearing the new destination the aircraft broke into the clear and almost immediately the copilot's airspeed began to increase. Within five to 10 minutes it agreed with the pilot's. Postflight inspection revealed the right pitot tube heater to be inoperative.

EGT HANG-UP — OVERTEMP? An F-104G pilot complained of an EGT hang-up at an indicated 640°C on a pre-takeoff throttle burst check. The engine was ground-checked and although it checked out OK, the temperature amplifier was changed as an "educated" precautionary measure. Subsequent engine operation was normal and shortly thereafter this engine ran out its PE inspection interval and was replaced.

Later, another pilot, in the same aircraft, encountered a temperature hang-up at 640°C after coming out of AB. An emergency was declared and landing was made without further incident. The pilot could give no information concerning the behavior of other engine instruments. Since the engine had been changed shortly before, the EGT gage was considered suspect and subsequently changed. Engine operation has since been normal.

Meanwhile, during a new engine installation ground runup on another ship, the EGT was seen to peak at 640°C and hang-up while the throttle was retracted to idle. RPM, fuel flow and nozzle position followed the throttle. Jarring the instrument panel brought the EGT gage needle back to normal. This was repeated several times with the same results. The instrument was removed and rejected to overhaul.

The experiences related above are probably not isolated cases. Be alert for this type of problem and observe the other engine instruments when an apparent over-temperature is encountered. This could substantially reduce troubleshooting manhours and unnecessary parts replacement.

From a Field Report by
W. A. Kerr, General Electric

SPOTS—If you think your eyes are playing tricks on you as you come down final and try to blink away those big yellow spots on the runway, don't panic! The spots are for real — they're aviation yellow, ten feet in diameter and centered 30 feet apart. Their function is to mark the location of BAK 6, 9 and 12 barrier pendant cables. The cable location will be marked when it crosses an operational portion of a runway, including cables on the approach side of a displaced threshold when the pavement is used for aircraft movements. Internally lighted signs the size of runway distance markers and featuring a yellow disc will also mark the location.

HOW TO GO OUT OF BUSINESS FAST—To paraphrase the last sentence of a message concerning an Aero Club incident: The .... Aero Club will be closed and the aircraft will be disposed of in accordance with . . .

Here's what immediately preceded this action: A T-34 was being ferried from a private field to the Air Force base. On preflight the pilot found that the left brake was not operating so he had a licensed FAA mechanic bleed the brake. It then appeared to operate satisfactorily so the pilot took off. After landing at the air base he found that the left brake was again flat, so he pumped it a few times and it came up to normal. As he taxied down a slight incline near the transient alert building, he applied brakes and the left brake again failed and the right brake locked causing the aircraft to turn into a concrete curbing which damaged the nose gear and prop.

Prior to this mishap another T-34 owned by this club was lost in a major accident. Other factors having bearing included lack of participation by club members and lack of adequate active duty personnel to properly supervise and monitor the club activities.

THOSE TINY TIME CAPSULES — Awhile back a young troop was having that "ache-all-over" feeling and he evidently wasn't satisfied with the assistance he was getting from the flight surgeon. His wife said she had just the thing to make him feel like a million. (A million what she didn't say.) Young troop started taking his wife's tiny time capsules and after being on them for a short time, he did indeed begin to feel wonderful.

Meanwhile, back at the base, young troop was scheduled to fly wing in a two-shipper. Down with the pills, on with the G-suit. Takeoff and the first few minutes of the flight were OK. After being airborne about 15 minutes, things started to happen.

The wingman didn't like his position so he started to move in. Lead didn't like the new position so he told the wingman to move out. Lead called the wingman to move back in. Full AB and CHARGE. Leader pulled up just in time as Number 2 went smoking through the spot that Lead had just vacated. The same thing was repeated a few more times.

For the next few minutes the two pilots engaged in one of the most heroic air battles since WWI. Lead tried to outrun Number 2 but he had the slower bird. After trying all of the old tricks and inventing some new ones, Lead got on Number 2's tail. Lead, in a high pitched voice, convinced Number 2 to just fly straight and level, then return to home base. The wingman was a little reluctant to break off the fun but the leader was more reluctant to be airborne with him. An uneventful landing was made by both aircraft except the leader was now ten pounds lighter.

Turned out those tiny time capsules the wingman was taking contained belladonna. Belladonna (beautiful lady) is known in medical circles as a mydriatic, a drug used to dilate pupils of the eyes. After the wingman swallowed his pills, he had to get pretty close to the leader to be able to see him!

PLEASE leave medications to the Flight Surgeon and the washing of dirty socks to the wife.

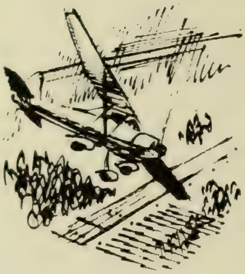
(From ATC's Approach to Safety)

Aerobits

AERO CLUB AWARDS—Forty-nine Air Force aero clubs received Federal Aviation Agency flight safety certificates for operating during 1964 without accident or incident. Major command representatives accepted the awards for the 40 recipient clubs which are based in the ZI during ceremonies at the FAA's Washington headquarters. The nine overseas clubs received their certificates by mail.

The awards were indicative of improved aero club safety since just under one-half of the 108 clubs were recipients. During 1964 the clubs flew 177,658 hours.

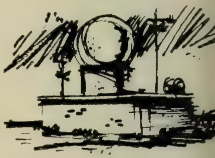
The following clubs received certificates:



ADC—	Adair Air Force Station
	Hancock Field
	Kingsley Field
	Otis AFB
	Oxnard AFB
	Perrin AFB
	Richards-Gebaur AFB
	Stewart AFB
	Tyndall AFB
AFLC—	Griffiss AFB
	Kelly AFB
	Olmsted AFB
	Tinker AFB
AFSC—	6594th Aerospace Test Wg
	Arnold Air Force Station
	Kirtland AFB
	Patrick AFB
	Space Systems Division
ATC—	Craig AFB
	Lowry AFB
	Randolph AFB
	Moody AFB
	Webb AFB
AU—	Maxwell-Gunter AFB
MATS—	Charleston AFB
	Scott AFB
	McGuire AFB
SAC—	Beale AFB
	Ellsworth AFB
	Lincoln AFB
	Vandenberg AFB
	Bunker Hill AFB
	Larson AFB
	Schilling AFB
	Whiteman AFB
CONAC—	Davis Field
	Minneapolis-St. Paul Int'l Airport
	Dobbins AFB
TAC—	Seymour Johnson AFB
USAFA—	USAF Academy
PACAF—	Clark Air Base
	Misawa Air Base
USAFE—	Bitburg Air Base
	Laon Air Base
	Wheelus Air Base
	Bentwood Air Base
	Freising Air Base
	Toul Rosieres Air Base
USAFSC—	Albrook AFB

A NEW RADAR that will enable forecasters to know current cloud structure and changes above a station has been installed by Air Weather Service at L. G. Hanscom Field, Mass. The first operational piece of weather equipment produced under the 4331 Weather Observing and Forecasting System, the TPQ-11 Radar Cloud Detecting Unit will be installed at 43 Air Force bases.

Pilot reports have been the only accurate source of information on clouds above the lower layers. The new equipment detects, displays and records the top and bottom heights and density profiles of clouds and precipitation directly above the installation from 500 to 60,000 feet. ★



FALLOUT continued

the dump valve at the trailing edge of the wing. He immediately discontinued the fueling operation, checked the cockpit, and found the fuel dump valve switch in the "open" position. Of course the pilot had forgotten to reposition the switch to the "off" position after landing.

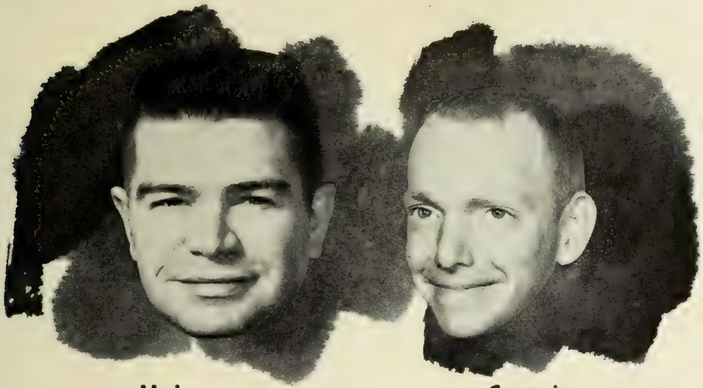
This same airman was involved in another incident on the same day, where his alertness in detecting a potential fire hazard in an MD-3 unit possibly saved an aircraft. Although both actions are expected of a five level airman, nevertheless it is a real pleasure when we can report that his actions did prevent possible serious incidents or accidents. I feel that suitable recognition could be accorded our more or less forgotten personnel in the Transient Alert functions. I would like to offer the name of A1C James T. Mosley for recognition in your magazine.

Consider the plight of the maintenance man! The majority of the transient maintenance personnel who do make mistakes are not willfully negligent, or indifferent, neither are they completely lacking in their skills. Whenever peculiar situations arise, rain or shine, snow or blow, the transient maintenance man is there to help you, and oftentimes all he is looking for is a kind word, just as assurance or reassurance that he is "doing a fine job."

SMSgt Walter A. Zardecki
Base Acft Maint Division
Olmsted AFB, Pa.

☆ U. S. GOVERNMENT PRINTING OFFICE 1965 751-218/9

WELL DONE



Major
CHARLES A. SAMS

Captain
CLIFFORD W. LANDIS

123 FIGHTER INTERCEPTOR SQUADRON, OREGON ANG, PORTLAND, ORE.

Major Sams was the pilot and Captain Landis the radar interceptor officer on a cross-country flight from Portland, Ore. to McClellan AFB, Calif. in an F-89. While they were descending to 7000 feet, Sacramento Approach Control informed them that there was a lost aircraft in their area and asked if they had enough fuel to make a search. Since they had nearly 8000 pounds of fuel remaining they agreed to do so. The lost aircraft, a single engine Swift, was approximately 60 miles northeast of Sacramento, heading due west, and was thought to be at about 12,000 feet.

Sacramento Approach Control vectored the F-89 into a tail position about five miles from the Swift and cleared them to climb to 11,500 feet. They entered the clouds at 8000 feet and climbed to 11,500 feet. At a range of two miles, Captain Landis picked up his target on radar, but it was very high on the scope. Major Sams slowed the F-89 to 130 knots with gear and flaps down. Upon getting radar contact with the Swift he lit both afterburners and established a climb at 125 knots to 18,000 feet. At about 200 yards range, visual contact was made with the Swift which was holding steady at 270 degrees bearing with an airspeed of 90 knots. Major Sams waggled the wings of the F-89 as he went by but the pilot of the Swift did not see the fighter and visual contact was lost. Sacramento Approach Control again vectored the F-89 into a tail position and again an actual weather intercept was made at 125 to 130 knots, minimum control speed. This time the F-89 passed closer to the Swift and the pilot saw the F-89. Major Sams turned to a heading of 310 degrees leading to an area where he knew the weather was broken to scattered. The Swift started to follow but the pilot lost sight of the F-89 in the clouds. Successive intercepts were made in the same fashion until, all told, six radar intercepts were accomplished, all at minimum control speed, before the Swift was guided to an area of clear weather conditions.

In the meantime Sacramento Approach Control had vectored a Navy U3A into the area to pick up the Swift and escort it to Sacramento. Once the F-89 got the Swift into clear weather and began a descent, Approach Control joined the U3A with the Swift and it was escorted to Sacramento Municipal Airport.

A civilian light aircraft was saved from possible destruction and the pilot's life was probably saved by the persistence and professionalism demonstrated by Major Sams and Captain Landis in conjunction with Sacramento Approach Control. WELL DONE! ★

CITATION FOR THE AWARD OF THE 1964

Daedalian
FLYING SAFETY TROPHY

SAC
STRATEGIC AIR COMMAND

The Daedalian Flying Safety Trophy is awarded to the Strategic Air Command for having the most effective aircraft accident prevention program of all major air commands for calendar year 1964. During the period of this award, the Strategic Air Command established the lowest accident rate in its history. The well defined and effective Strategic Air Command accident prevention program proved itself in the successful completion of thousands of sorties flown in special exercises and the unique strategic mission. During this period, aircraft accident fatalities were reduced by thirty per cent. By conserving lives and materiel, while accomplishing its worldwide commitments, the Strategic Air Command has made a substantial contribution to the mission of the USAF. This accomplishment was the result of superior teamwork of unit commanders, aircrews, maintenance and support personnel. The achievement made by the Strategic Air Command in aircraft accident prevention perpetuates the highest standards and traditions established for the Daedalian Flying Safety Trophy, and reflects the highest credit upon the command and the United States Air Force. ★

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FLYS

AEROSPACE SAFETY

UNITED STATES AIR FORCE

JULY 1965

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AUG 18 1965
UNIVERSITY OF ILLINOIS

Rough Rider '64
see page two

AEROSPACE

SAFETY

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AFRP 62-1 VOLUME 21 NUMBER 7

FALLOUT

HELP REX

Dear Tom

My associate, Rex Riley, is mighty unhapp
these days; and when he is unhappy, he
most difficult to work with. When I broug
him his usual cup of coffee and aspirin, h
was staring at a map of USAF active maj
installations.

Twenty minutes later he had not touche
the coffee and three aspirin. He held up th
map. "Toots, LOOK at all of these 180 base
that we have in the U.S. and abroad . . .
least half of them should be on my list
outstanding bases!"

I told him he didn't have to yell, but h
didn't hear me. He went on: "I know the
are some good bases that I haven't looke
at, and probably never will — you see, I ca
spread myself out just so thin."

I nibbled on his untouched aspirin and to
him sympathetically that I thought it wou
certainly help matters if all of the pilots wou
give him a hand by evaluating the bases the
visit, and write to him when a base is pa
ticularly good or bad. Imagine me telling Re
that that's the way he could get full coverag
and that the bases he would have to che
(the particularly good or bad ones) wou
be limited to a reasonable number that h
could evaluate properly.

I waited breathlessly as he reached for h
coffee and one aspirin. I knew that he kne
that, without my telling him, but m
"woman's intuition" told me that he ju
wanted someone to agree with him. He d
clared, innocently, "Why, Toots, that wou
solve the problem; why don't you write yo
friends on AEROSPACE SAFETY magazine an
ask them to query the pilots on this for me?

So, there you have it, Tom. To get Rex o
that aspirin kick, how about asking yo
pilots to give him a hand?

TOOTS

*Rex really does need assistance. I used
help him with his program . . . before th
awful phrase, "45-22," came along. Th
cleaned out a bunch of us not-so-terribly-o
jocks. You'll have to agree that 180 bases a
a lot for one man to visit. His program
operated exclusively for your benefit, yo
know. Write Lt Col Rex Riley, DTIG, USA
(AFIAS-E2), Norton AFB, Calif 92409.*

Recommendation: That AEROSPACE SAFETY publish an article summarizing this accident and stressing the importance of personal equipment.

OUT OF THE HOT SEAT

Twenty-seven minutes after takeoff the F-89 was cruising at 31,000. Cloud tops were 5000 feet below. An Air Force base was 45 miles away. Suddenly, severe vibrations shook the aircraft. Quickly, the pilot scanned the cockpit. Two lights flashed on, indicating failure of Nr 1 and Nr 2 right hand generators. The pilot interpreted these lights to be an indication of trouble in the right engine. He reduced power to idle on the right engine and to 89 per cent on the left. He requested and received a vector to the Air Force base. While descending he attempted to reset the generators without success. He broke out of the clouds at 18,000 feet, 18 miles west of the base. Vibrations continued. Now the pilot noticed smoke in the cockpit. He stopcocked the right engine. Vibrations still continued. He spotted the field and lowered the gear, preparing for a single engine landing. When over the end of the runway at 14,000 feet severe explosions jarred the aircraft ("like running the nose wheel over a railroad track," was the way the pilot described it). They came from the left engine. He shut it down by using the fire selector switch and stopcocking and attempted to restart the right engine. The smoke was getting worse, no let up in vibrations.

Flames dictated the next course of action. The pilot noticed the flames on both sides of his seat. The left overheat warning light came on. He decided to eject. He used the fast jettison T-handle to jettison the canopy rather than the right arm rest. The canopy separated. Smoke and flames were increasing. The flames were blue, as if coming from blow torches. They were worse on the left side. The pilot was having difficulty locating the left jettison handle in the flames. His visor was not down and, although he doesn't remember removing it, there are indications that his oxygen mask was not on. (Investigators felt that the mask came off when he jettisoned the canopy.) Flames were spreading and his face, except for the area protected by the helmet and chin strap, was being burned. He had steered away from the field, toward a wooded area, and had managed to pull the left ejection handle. The board reasoned that, because he had used the T-handle rather than the arm rest, perhaps 10 to 12 seconds delay ensued between the time the canopy departed and he was able to eject himself. Ejection was fully automatic and without incident. The chute canopy caught in a tree top and the actual landing was quite gentle. The base had been alerted to the emergency, the Air Rescue helicopter was airborne and picked up the pilot one minute after he landed.

Injuries consisted of second degree burns of the face and right hand and third degree burns to the left hand. The medical officer observed that flames had apparently reached the top of the cockpit, permitting burning of the face in areas not covered by the helmet. He also observed that the tinted visor was not down, and that had it been down facial burns might have been reduced by one-third. Severity of burns to the pilot's hands resulted from the failure to wear gloves. The intense heat melted or burned much of the synthetic material in the legs of the winter flying suit. However, the flannel layer underneath remained intact and afforded the pilot protection. Leather boots, two pairs of socks and a flying jacket provided additional protection.

Reviewers concluded: This accident again illustrates protective measures afforded by use of visors, gloves and adequate clothing; the value of knowing the ejection routine; the importance of deciding and acting rapidly in an ejection situation; the role of prompt rescue action and medical care.

TDR's disclosed that the vibration stemmed from loss of a turbine blade in the left engine. Two possible explanations are given for failure of the two right hand generators, which led the pilot to erroneously believe his troubles were with the right engine:

1. Over-voltage of the left generator and failure of the over-voltage relay to disconnect the left generator from the primary bus. The reverse current relays on the two right hand generators would then disconnect them from the primary bus.

2. A short or open circuit in the control circuitry for the right hand generators. These circuits are located in the left engine intake duct and could have been affected by the vibration of the left engine.

While on single engine in the overcast between 26,000 and 18,000 feet the pilot was preoccupied with flying instruments, navigating for position and communicating with Center. In addition, he was faced with severe vibrations in the aircraft, smoke and subsequent fire. Under such circumstances, the failure of the pilot to identify indications of left engine malfunctions are considered reasonable. ★

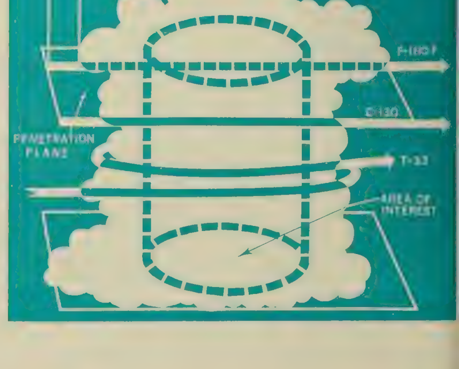
ROUGH RIDER 1964

By Major O. Patrick Arquilla, ASD, Wright-Patterson AFB, Ohio*

In flights through thunderstorms, the pilot and his airplane are too often the loser. This fact is evident if you examine the frequency of jet airplane accidents and incidents attributed to thunderstorms during the past few years. It is the purpose of this paper to present my experiences during flights through thunderstorms. Also, to present a general review of techniques and cautions that may be observed while penetrating thunderstorms in hope of clarifying some of the factors leading to defeat.

In 1946-47 a joint civilian and military effort participated in a test program called "Thunderstorm Project." As a result, there was a great advance in the technological understanding of the mechanism and composition of thunderstorms and the hazards encountered in flying through them. However, those studies were generally limited to the lower altitudes (below 26,000 feet). Since that initial effort, the type of aircraft and scope of operations of both commercial and military aviation have so expanded that new problems have arisen in connection with thunderstorm flying.

The advent of jet aircraft into commercial aviation raised the operational ceiling well above the 25,000 foot level and caused the U.S. Weather Bureau to initiate steps to obtain details of upper air information for their aviation customers.



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*The author requests that note be made of the fact that the conclusions herein are his and not necessarily those of the Air Force.

Simultaneous with this effort, the U.S. Air Force also recognized the lack of information at high altitude in thunderstorms. Pressed by several accidents, the Air Force began formulating a plan to obtain data on the detection, avoidance and flight techniques required to fly in areas of thunderstorm activity. The formulation of this plan became the responsibility of the Aeronautical Systems Division (ASD) in the Air Force Systems Command.

The plan is called project "ROUGH RIDER." It is a joint effort with the U.S. Air Force, U.S. Weather Bureau, Federal Aviation Agency, and the National Aeronautics and Space Administration. Flight testing began in 1960 and has continued every year since. Of particular note, I direct your attention to the successful completion of five years of flight tests, and the accumulation of severe storm data during 564 storm penetrations, through an altitude envelope of 15,000 to 45,000 feet and a speed envelope of 175 knots to 1.72 mach *without* a single loss of aircraft. This impressive record and the experience gained by ASD test pilots is the basis of most of what I have yet to say. First, however, I'll outline last year's project.

TEST PROCEDURE — ROUGH RIDER 64

Test data gathering flights were flown simultaneously by a C-130, a U-2 and the penetration aircraft – an F-100F (Figure 1). The U-2 flew at high levels over the top of the cloud; while at the same time, below and about two to five miles behind, the F-100F penetrated the cloud while the C-130 flew outside the cloud approximately parallel and at the same level of the F-100F. This flight pattern was used for recording simultaneous electric field measurements of selected storm complexes.

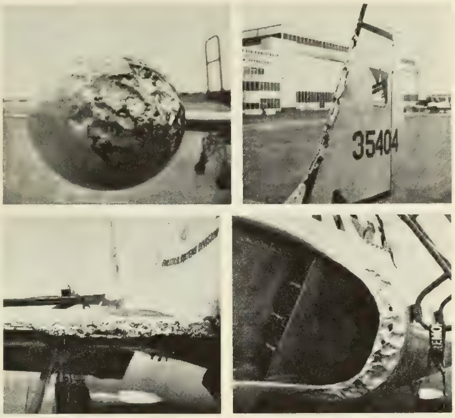
A B-47, from ASD, participated by dropping chaff above the storms. Chaff drops were made only *after* storm penetrations were completed. Many times the altitude of the storm top was higher than the service ceiling of the B-47. For such cases, chaff drops were made around the thunderstorm complex. The experimental chaff drops were very successful in discerning differential movement between the outer edges of the cloud systems and the storm center. Wind flow patterns near the top of storms were also studied.

The only other test aircraft involved in Rough Rider 64 was a U.S. Weather Bureau F-11. This aircraft was under the sole operational control of the U.S. Weather Bureau. Its primary function was to climb outside the storm at a rate-of-climb equal to the rate-of-vertical lifting of the storm top.

Finally, we had a T-33 safety chase aircraft that orbited outside the storm area while the F-100F penetrated. The value of having a safety chase aircraft has been proven on several occasions during Rough Rider 64 (for which I was very thankful) and also for previous years.

I flew a total of 128 thunderstorm penetrations during Rough Rider 64. Much of what I experienced is applicable to all high performance jet aircraft. Enough for the background of Project Rough Rider. Now I'll move on to thunderstorm experiences — mine and those of other test pilots in ASD.

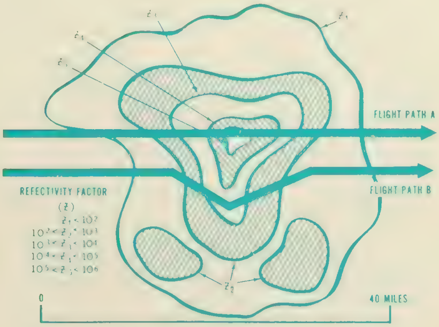
FLIGHT EXPERIENCES IN THUNDERSTORMS REFLECTIVITY



During Rough Rider '62, a T-33 penetrated a mild-looking thunderstorm. Note hail damage. Author says appearance no criteria.

"Never judge a thunderstorm by how it looks from the outside." That is an axiom which five years of flight testing has proven. Tops of thunderstorms may appear to be at a level that is often misleading. Formations which *appear* to be no more than 25,000 feet from a distance may prove to be well above the service ceiling of today's high performance jet aircraft. Some of the most vicious-looking storms proved to be real fizzles. Yet, other relatively innocent-appearing towering cumulous cloud formations were violent enough to cause severe aircraft damage. I am certain that in some of our penetrations loss of aircraft and crew was averted only because of the high caliber of ASD test pilots, coupled with the type of aircraft used as a test bed. Damage suffered by a T-33 that penetrated a mild-looking storm system is shown in Figure 2. Is there a way of knowing what storm systems may be penetrated safely without serious risk of damage or crash? YES!! What is it? Well, let me explain.

During Rough Rider 61, the U.S. Weather Bureau's WSR-57 radar was used to examine storms. Incorporated with the WSR-57 radar was an alternate level banking contour circuitry. This attenuation feature provided simultaneous display of different levels of



echo intensity. Figure 3 shows the attenuation of five levels of echo intensity for a typical storm. Radar *reflectivity* factors have been derived from photographs of the plan-position indicator with the WSR-57 radar antenna elevated to illuminate the volume containing the penetration aircraft. Consecutive antenna scans are at 15 second time intervals and 6 db steps of the radar receiver sensitivity. The radar reflectivity is approximately proportioned to the precipitation constant squared.

This is all fine and dandy — but what does it all mean? Well, from Rough Rider 61 through Rough Rider 63 it was established that an F-100F aircraft penetrating a storm where the reflectivity (Z) was 10^5 or greater (Figure 3, Flight Path A) the aircraft would suffer structural damage. The degree of structural damage was dependent on the value of reflectivity. During Rough Rider 64, all the penetrations, except one, were vectored through the storm area where reflectivity was less than 10^5 (Figure 4, Flight Path B). Out of 128, I flew 127 successful penetrations without any damage to the aircraft.

It is possible, with proper radar equipment, for aircraft to be *safely* vectored through severe storm systems. But, remember this, a proper reflectivity value must be known for the particular type of aircraft being flown. I am certain that safe penetration reflectivity value is *not* the same for all types of aircraft.

On the one exception mentioned above, the reflectivity value was much greater than $Z = 10^5$. In fact, on that particular flight, I flew through the upper portion of a tornado that hit Yukon, Oklahoma, on 1 May 1964. The turbulence that I ran into was very severe, and maintaining aircraft control became my most important objective. This leads me into the subject of turbulence.

TURBULENCE

Personally, I most fear and respect turbulence over all other weather phenomena, and I think this is true of many pilots. Certainly, pilot discomfort and aircraft stress resulting from severe vertical gusts contribute to this philosophy. Present high performance airplanes are designed to withstand reasonably large acceleration loadings. They are not susceptible to structural failure under normal operational limitations. The key to safe turbulence flying is to stay within the normal operational limits of the airplane. But, we all know that flight conditions may exist under which this is easier said than done.

None of the airplanes flown by ASD pilots during Project "Rough Rider" were damaged by turbulence. The accelerometer in the penetration aircraft was repeatedly pegged in both directions. Yet, careful post-flight inspections of the aircraft failed to reveal any signs of overstress. I remind you that aircraft accelerometers are usually over-sensitive to "jar type" accelerations. Under severe gust-like turbulence conditions, accelerometers do not always reflect actual stress loads on the airframe.

Further, we have not had a turbulence associated loss of control in any of the 564 penetrations flown since 1960. Proper aircraft control in a thunderstorm is a serious problem. Yet, from a controllability point, thunderstorm flying in a fast moving jet is probably easier than in slower moving prop airplanes — excursions in altitude, airspeed, heading and attitude are not nearly as great.

Now is an appropriate time to present an extract of a tape recording made during the penetration in which I flew through the top of a tornado (R.R. 44 is me; R.R. Control is Mr. Howard Murphy, an FAA Controller; Lt Miller is the test engineer who rode in the rear seat of the F-100F to record test data; time is in minutes and seconds after starting recorder).

TIME	SUBJECT	COMMENTARY
13:00	R.R. 44	"Now the turbulence is picking up just a hair . . . . Slightly more turbulence, the sky is getting just a little bit darker . . . . Turbulence is increasing."
13:30	R.R. Control	"Say again."
	R.R. 44	"Just a little more turbulence; the sky is getting darker . . . . Turbulence has increased to a moderate level now . . . . It's a nice steady moderate turbulence . . . Ah, it's a pretty good jolt there . . . . I'd start to call it rough now."
14:00		"Rough turbulence, some precipitation, looks like heavy rain, might be some hail in it . . . . Lightning strikes in the area . . . . We are encountering hail . . . . I definitely hear hail noise . . . . More lightning strikes . . . . Lightning strikes."
14:30		"Lightning strikes, severe updraft!!! Severe updraft!!!
15:00	R.R. Control	"Four four freq check."
	R.R. 44	"Rog, four four here."
	Lt Miller	"We're getting (BANG) ice on both the temperatures — (BANG, BANG, BANG-BANG, BANG, BANG — BANG)." . . . . CENTER LINE PYLON IS LOOSE . . . . SOMETHING IS BANGING —"
	R.R. 44	"Now, now."
	Lt Miller	"DIRECTLY UNDER MY FEET."
	R.R. 44	"now, now, now — that's just compressor stalls."
	Lt Miller	"OH! ha, ha, ha. Well, I'm a beginner."
	RR. 44	"Never mind."
	R.R. Control	"Four four freq check."
	R.R. 44	"Four four, — we ran into severe compressor stalls."
	R.R. Control	"Roger, you want to get out?"
	R.R. 44	"Yeah, if we can."
		again, left turn to a heading of three zero zero; three zero zero."

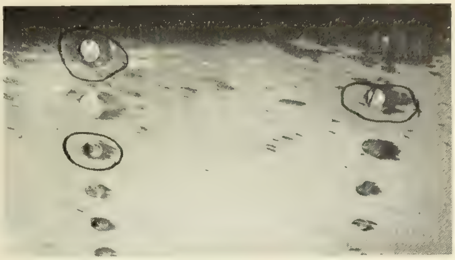
In narrative form this is what happened: Shortly after entry into the storm I encountered moderate turbulence. Then, simultaneously the sky got darker, turbulence increased and precipitation was evident. Next, as the turbulence became most severe — the precipitation (rain, hail, slush and snow) was the heaviest yet up to this time, a real wall of water — lightning strikes all around — we were in a severe updraft. As the airplane was being pushed up, the rate-of-climb indicator was pegged at 6000 feet per minute and the airspeed needle went from 275 knots to 394 knots. As I passed through 29 to 30,000 feet, I glanced out and saw that the wing slats were half out. Experience and airplane know-how told me it's not right to have half slats and a speed of 394 knots!! By this time we were passing 31,000 feet and the engine was in compressor stalls. It sounded like we were sitting on top of a machine gun and the pounding was enough to lift my feet off the rudder pedals. Tieing the compressor stalls in with the slat position, I suspected that the stalls were a result of too slow an airspeed. The altitude dial now read 33,000 feet and I started to push over to a 15-degree nose down dive. I had to get real airspeed not needle speed. While pushing over to keep from stalling, I turned on emergency ignition and emergency fuel to keep the engine from a flameout — all of this was going on at the same time that I was trying to calm my flight test engineer and still keep Rough Rider Control aware of what was happening. (This was the flight test engineer, Lt Ed Miller's, first flight test project. Ed had just been graduated from Penn State and was in the Air Force only three months before all of this happened.) Well, to continue, the airplane is set in a 15-degree nose down dive, the engine is at full power, and the airspeed needle smoothly turns counterclockwise and stops at 200 KNOTS. I'm now passing through 29-28,000 feet. By the time I pass 26,000 feet, the airplane is in a buffet and felt typical of speeds near 0.95 mach number. A glance at the airspeed needle, it reads 220 knots; a glance at the slats, they're full in; again this is not right!! I make a gradual smooth level off at 22,000 feet, set the airplane at level flight using the attitude indicator and adjust power setting for normal penetration airspeed. I exit the storm and the safety chase T-33 is there to pace me back for a safe landing at Tinker AFB, Okla.

As a result of a hail stone impaled on the end of the pitot tube and a pitot heater that did not work, I experienced about everything short of catastrophe, that may be experienced in a thunderstorm. Let us examine a few of these experiences, not necessarily in the order in which they occurred.

Compressor stalls: Compressor stalls, flameout or both is the most probable consequence of throttle jockeying and excessively slow airspeed at high altitudes, say above 30,000 feet. It is much safer to penetrate the most severe storm at the proper airspeed than to "flounder" into the top in a near stalled condition.

Airspeed malfunctions: If you have an angle of attack indicator, use it. (The F-100 wing slats act like an angle of attack indicator between their limits of movement.) If this instrument fails or you do not have one, use the attitude indicator. Fly attitude. Cross-checking with other instruments is the only way to detect incipient airspeed indicator failures. If the pitot tube is blocked you will have an increased indicated airspeed as altitude is increased and a decrease in airspeed with decreased altitude. However, do not confuse airspeed malfunctions with some airspeed increase when in heavy precipitation. Instead, this should be expected because of water injection effects. An increase in thrust is a result of the increased mass flow through the engine. A 10 knot increase in airspeed was a common experience.

Precipitation damage: Except for a couple of weak areas, most aircraft withstand hail quite well. I'd say damage caused by water erosion during supersonic penetrations is more serious than that caused by hail, only because of the greater frequency of encountering water rather than hail. ASD engineers calculated the impact pressure created by water to be 18,000 pounds per square inch when flying at a speed of 1.6 mach number. This pressure will peel flush rivet heads out of the leading edge. (See Figure 4.) Plexiglass is worn down, fiber glass antennas eroded away and paint peeled or impinged off. To keep precipitation damage to a minimum, penetrate at the recommended air speed, not faster.



F-106 wing leading edge flush rivets that were peeled by rain impingement during supersonic penetrations of severe thunderstorms.

Turbulence: I am convinced that turbulence is in direct proportion to the amount of precipitation present. That is, when the turbulence starts to get heavy you can expect heavy precipitation, or when you start to encounter heavy precipitation you can expect severe turbulence.

Up to now I purposely avoided mentioning lightning because lightning is my last subject before closing.

LIGHTNING

Two years ago, on the east coast, a jet transport caught fire and crashed while flying through squall line thunderstorms at a low altitude. The possibility of a lightning-caused fuel explosion was raised in connection with this accident. The CAB found that the accident was probably due to lightning induced ignition of the fuel/air mixture in the Nr 1 reserve fuel tank with resultant explosive disintegration.

To measure electric field data and record lightning signatures inside and around thunderstorms was the major test objective of Rough Rider 64. Along with this test objective, we were asked by FAA to investigate the possibility of lightning igniting fuel vapor. A specially instrumented external tank and pitot boom was manufactured to collect data for this investigation. The F-100F test aircraft is shown during ground check in Figure 5. Our goal was to actually trigger or intercept lightning strikes and to record the lightning signature and overpressure of electrical discharges inside and around thunderstorms. As far as I know, this was an aviation first.

Some typical effects produced by a lightning discharge are: intense electric field and streamering, magnetic forces and fields, heating and blast effects and metal erosion. These are the forcing functions affecting airplane systems. I will not get into the mechanism through which charge separation and hence lightning occurs. I will briefly discuss the nature of lightning.

As a thundercloud develops, the potential difference between the cloud base and ground continually rises to a very high voltage (ten to one hundred million volts). When the electrical pressure gets too great, the air resistance is completely overcome and a torrent of electrons — lightning — passes to the earth below. (This occurs when a potential gradient of between 15 to 30 KV/om causes dielectric breakdown of the air associated with these conditions.) An average thunderstorm may fire 10 to 20 strikes of lightning per second. Each discharge lasts less than half a second and releases great amounts of energy (more than one million billion ergs). From a typical thunderstorm the total release of electrical energy may be in the order of 10 million kilowatts per second. This can result in peak currents from a *single* strike of greater than three hundred thousand (300,000) amperes and a total charge transfer of as great as one thousand (1000) coulombs.

Enough on the nature of lightning. To continue, I estimate the F-100F I was flying was struck more than 100 times during Rough Rider 64. Figure 6 shows some typical lightning damage. To answer probably the most interesting question you may have at this moment, we do not have any conclusive evidence that lightning will cause fuel vapor to ignite. I do not discount, at this time, the possibility of catastrophic fuel explosions resulting from lightning discharge. The space above the liquid fuel is filled with a mixture of vaporized fuel and air. The proper ratio of fuel vapor to air forms a highly explosive mixture.

There are at least five possible ways of an electrical discharge setting off a fuel explosion. They are: (1) a lightning strike burning a hole through the wall of the fuel tank; (2) a direct lightning strike to a fuel vent; (3) a strike to any part of the aircraft with the resulting high voltages causing arcing across the fuel vent; (4) adiabatic compressional heating in the fuel tank from a strike in the immediate vicinity of a vent; and (5) electrostatic arcing across the vent when the aircraft is flying in an intense electric field.

Unfortunately our instrumentation did not function as well as we had hoped. What data we did collect is still in the process of being analyzed. Project Rough Rider will continue in 1965; the instrumentation will be improved to get more conclusive data. One of the many things we learned during Rough Rider 64 was how we should improve our instrumentation to get the required data. But for this aviation historical first, we feel the entire program was very successful.

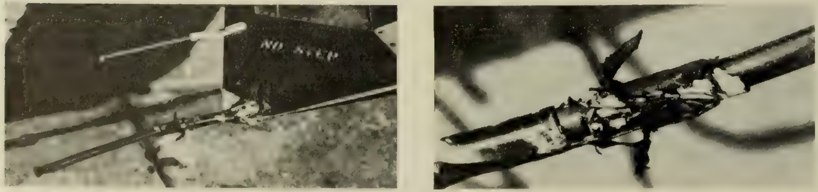
Ground check of lightning data collection equipment on the F-100F.

SUMMARY

In five years of participation in Project Rough Rider, the test pilots under the Deputy for Flight Test in ASD contributed immeasurably to flying safety for both civilian and military aviation. Some specific and unusual events discovered during the past five years are:

- Liquid water at 40,000 feet where the outside air temperature is well below freezing.
- Hailstones at 45,000 feet in completely clear air as far as five miles from the storm on the down wind side of the storm.
- Storms may build at a rate of 6000 feet a minute or greater.
- At high speeds, ice crystals or liquid water could cause as much damage as hail.
- Supersonic penetrations were possible and that bumpiness does not increase with speed as it does in the subsonic range.
- In areas of high electrical activity the 75 mc marker beacon light will flicker or glow brightly before an electrical discharge.
- Lightning strikes caused hair on head and arms to literally stand on end.
- Lightning is the most spectacular element encountered in a thunderstorm, the most startling, the most disturbing and right now the least understood.
- During severe turbulence proper aircraft control will require maximum pilot ability and techniques. Attitude flying is the only way you can hope to prevent catastrophic failure. Excursions in altitude and airspeed should not be chased. As best you can, maintain attitude and power settings for best penetration speed to ride out the storm.
- Finally, to repeat an old phrase — AVOID THUNDERSTORMS if at all possible. ★

Some typical lightning damage. The F-100 was struck more than 100 times during Rough Rider '64.



THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q On a flight from point A to B, you choose C as your alternate which is 400 miles from B. When arriving at B you are informed that the weather is below minimums. There are two airports within a 150 mile radius of B that are reporting weather of 700 feet and 10 miles with Radar available and PAR minimums of 100 and one quarter. If you decide to divert to one of these airports, must you still have enough fuel remaining to proceed to an alternate from the new destination and have the required fuel reserve of 20 minutes or ten per cent? *(Captain Harry D. Hunt, Laredo AFB, Tex.)*

A Yes. In this case, diverting to the new airport is simply a change of flight plan. If your new destination weather requires that you list an alternate then you must do so and, of course, the fuel requirements still apply.

Q PAR minimums at our base are one hundred and a quarter. If the weather is at minimums, I will reach 100 feet on the glide slope before I reach one-quarter of a mile from the touchdown point. Should I start the missed approach when I reach 100 feet, or can I level off and continue to follow the controller's instructions until I am over the runway threshold? *(Captain John Carroll)*

A Remember, a PAR approach is designed to place you in a position from which you can make a visual landing. You should execute the missed approach procedure at minimum altitude as indicated on your altimeter or when the controller advises that you are passing minimums, whichever occurs first. Since the touchdown point is normally a minimum of 750 feet from the approach end of the runway you may not see the actual touchdown point when you reach minimums, but you must have sufficient visual contact to assure a safe landing.

Q Is there a mandatory requirement that clearances be read back by the pilot?

A Yes. In the case of ATC clearances issued by Air Force controllers, AFM 60-5 requires that the controller request a readback of the clearance to insure receipt as issued. However, if you receive a clearance direct from an ATC Center, a readback is not mandatory unless requested. Normally, acknowledgement that you received and understand the clearance is sufficient.

POINT TO PONDER

If corrective action is necessary when clear air turbulence is encountered what is the recommended inflight procedure?

The recommended procedure is to adjust airspeed to the proper turbulent air penetration speed for your type aircraft. If you have some advance warning that you are approaching an area of CAT and you can take steps to avoid it, by all means do so. However, the warning may be late in coming or it may not come at all. If this is the case, set the power to give you the recommended airspeed. Because of the turbulence you may not be able to maintain this airspeed but you can make smooth adjustments in pitch and roll by reference to the Attitude Indicator. During normal flight you should make corrections on your control instrument (ATTITUDE INDICATOR) when the performance instruments (Airspeed, Altimeter, Vertical Velocity, Heading Indicator) indicate a need for a change. During flight through turbulent air the performance instruments must be considered unreliable and the crosscheck can be limited to the Attitude Indicator. This does not mean that you should exert forceful control pressures to maintain a constant "picture" on the Attitude Indicator, instead you should make all necessary corrections smoothly and sort of "roll with the punches." This will help to avoid imposing extreme stresses on the aircraft and will help to prevent violent changes in aircraft attitude when going out of an updraft into a downdraft or vice-versa.

The use of trim must be considered carefully. Under normal flight conditions you should trim off pressures as the need arises. In flight through turbulent air the temptation to use large amounts of trim can be great. The best procedure is to set your trim control to the setting that will maintain level flight at the recommended penetration airspeed and leave the trim there. This applies to all aircraft and it is especially true in aircraft where changes in trim affect the position of the horizontal stabilizer.

Use of the auto-pilot in turbulence may or may not be recommended. Check your aircraft flight manual for the best procedure to follow in your aircraft. ★

WHAT MEETS THE THE EYE...

Real or Illusion?

The difference between appearances and reality can be not only mentally shattering but physically shattering as well. This is especially true if you are a pilot and fall for the deceptions created by various illusions present when landing an aircraft. Pilots are subject to many illusions, e.g., runway slopes, runway humps, width to length proportions, locations, size and brilliance of lights, contrast and background, convergence, light and shadow, and relative motion.

To review briefly, a pilot learns to fly using various reference points which for the benefit of this article will be called "illusions." The horizon "appears to be" even with the prop spinner for level flight. It is flush with the top of the nose on a normal approach and the pilot must pull back on the stick until the horizon cuts across the lower one-third of the cowl for a proper landing attitude. Different airplanes, different illusions, of course, but the principle is the same.

During training every pilot must learn to judge distance, direction and rate of closure. He must do this horizontally to arrive over the runway threshold at the proper altitude. He must be able to estimate height to determine the start and rate of flare; he must also detect lateral movement to compensate for drift. He must learn to blend these three directions and distances in order to land on the right spot, at the proper attitude and free from drift.

These are elemental aspects of flying. The simple truth is that until a pilot masters these skills he dare not solo.

It is basic that, in learning to fly, a pilot must first become proficient in visual flight skills. Then, and only then, can he progress to use of instruments and other aids. To this day, no matter how sophisticated the approach system, the pilot still must take over visually in order to flare and land his aircraft.

The pilot should always remember that instruments and navaids are merely *aids* to making an approach. At some point prior to start of flare he must rely on visual cues to land. He should also remember that, especially prior to the start of flare, he should use instruments and navaids to verify what he sees — or *what he thinks he sees.* The pilot who passes up the training value of having the ILS on during a VFR final approach is merely short-changing himself and everyone with him. He is passing up a free training opportunity and exposing all on board to unnecessary risk.

A study reported in this magazine last year disclosed that the leading cause of landing accidents was landing short. Yet it is a simple fact that staying on glidepath will prevent such accidents. In one tragic case the pilot was told to pull up, he was descending below safe limits. His retort, "I have the runway in sight." He crashed short of the runway, with a high fatality toll. The fact that the runway is in sight is no assurance of safe clearance altitude. From ground level, some runways can be seen several miles away.

What the eyes sees may not correspond with conditions as they actually exist. A 150-foot — 5,000-foot runway will look like a 300-foot-10,000-foot runway, especially if few other objects of known size are close by. A bright light appears closer than a dim light. If two objects are the same size, the closer one seems larger.

The higher the cockpit above the runway, the slower the apparent speed.

Have you ever tried to spear a fish? You plunge the spear into the water and, if you aim dead center on the fish you get a clean miss. Because of refraction, the fish was not where it appeared to be. The same refraction problem shows up when you make an approach in rain. The runway appears to be lower than it actually is. The solution, obviously, is to heed instructions from the GCA controller and cross check other aids such as your ILS and altimeter.

Believing your instruments is every bit as important during flight close to the ground as it is at altitude. When visual cues are limited, or distorted as at night, in precip, over water approaches, approaches to snow covered airfields, only the careless rely on eyeballs alone. Ten years ago, a major command that was experiencing a rash of landing short accidents abolished straight-in approaches. Rectangular patterns were flown and, where available, instrument approaches were made mandatory. A 50-foot, over-the-threshold rule was invoked. Their landing-short problem was solved.

To use "illusion" as a convenient whipping boy to explain mishaps promotes rather than discourages ac-

How long is the runway? A narrow, short runway can appear to be the same size as a long, wide runway. Don't guess. Check approach plates.

cidents. As pointed out earlier, every pilot had to learn to cope with such appearances in order to solo. To cry "illusion" because an aircraft hit short of a 10,000-foot runway when less than half the 10,000 feet would have been adequate is absolutely unacceptable, especially for professional pilots. For years Air Force pilots have successfully flown large transports into Alaskan White Alice sites with runway gradients of as much as 12 degrees, few relative size cues and 4000 feet of gravel runway. STRICOM pilots perform exacting delivery operations into marginal airstrips. Navy pilots successfully touch down in a 120-foot distance on a canted deck that continually slides away from them. True, they have a "meatball" to use as an aid in staying on centerline and glideslope, but many Air Force bases now have VASI lights. Use them!

Early in 1965 a large Air Force bird was making an approach with a reported 100-foot indefinite ceiling. When the aircraft broke out, the crew tried to stop drift and line up by banking the bird. Touchdown was tiptank first. The tank ruptured, fuel streamed from it but fortunately did not ignite.

In 1964 a similar situation occurred, but with more serious consequences. Again the pilots attempted to line up after breaking out under a reported minimum ceiling. They crashed in the attempt, destroying the aircraft. They tried a maneuver beyond the aircraft's aerodynamic capability. In other words, had weather been CAVU and the aircraft positioned at the point where the crew took over visually, it would have been impossible to fly from that point to a safe touchdown.

When material was being gathered for this article an aviation physiologist (and a qualified jet pilot) commented, "Illusions, smillusions, we're looking for excuses in an environment every pilot lives with every day. The good ones — those who don't have accidents — aren't excuse hunters. They believe their instruments, operate within their limitations, and have the good sense to go to an alternate when conditions warrant. All illusions don't occur during landing."

Often after a taxi accident the pilot will report that "it looked like there was room." Last year a pilot landed gear up, on takeoff, when the plane became airborne on an upsloping runway; he retracted the gear, but the runway climbed faster than the aircraft. In precip or clouds, rotating beacons can cause confusion, even vertigo, dizziness and nausea. Helicopter blades can create a similar condition. Pilots flying in the North Country must fight off false horizons and other distractions caused by the aurora borealis. Fatigue, hypoxia, intermittent precip and clouds, stars, lights on the ground, no natural horizon and autokinesis (apparent movement) are conditions that aggravate illusions. Last winter a pilot was killed when his fighter crashed into a lake during a low altitude flight. The lake surface at the time was calm and reflected like a mirror. There is a strong possibility that this pilot was unable to judge his height above the surface and simply flew into the water. It has happened before.

The solution:

Knowledge. Know of these things and be able to recognize them when they occur.

Rely on your instruments. Instruments are immune to the phenomena that create false impressions in the human pilot.

Check landing distance charts, and believe them. When 3200 feet is required, and 10,000 feet is available, don't try to land on the first inch.

Check approach plates for type of runway lighting.

Use navaids.

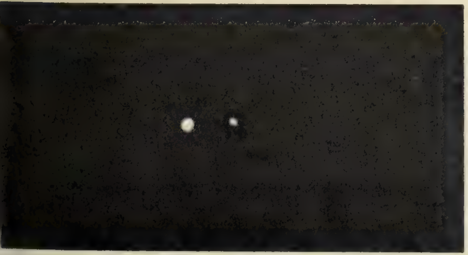
Have other crewmembers monitor, especially attitude instruments and altimeters.

Check approach plates for runway slope. When there is an upslope you will be lower than you appear to be. When there is a downslope you will be higher than you appear to be.

Abide by instructions from ground controllers. If warned you are low, pull up! Because of aircraft instrument lag and the fact that to the pilot appearances can be deceiving, instructions issued by the precision approach controller should be followed.

A lot of pilots have died proving the hazards of believing only what they thought they saw. And a lot more accident investigators have gone to great lengths to report such cases. The knowledge is there — only through blind ignorance, complacency and lack of self-discipline can such accidents continue to occur.

How sharp are your eyes? Did they catch the the title? ★



Is the light on the left closer or is it brighter, or larger? Don't trust your eyes alone. Use aids: ILS, GCA, altimeters, crewmembers.

Bug Smashers Can Be Safe

During the past year and one-half since this magazine last published a full-length article on aero clubs, a number of briefs have been carried in the Aerobits section, but, until recently, we've not taken a good look at overall performance. When we did, the look was encouraging.

The number of accidents during 1964 as compared to 1962, the last full year AEROSPACE SAFETY reported on, was cut by 50 per cent. Fatalities decreased even more. (Fig. 1). As the chart shows, some of the improvement must be attributed to curtailments in aero club activities overall. However, the big gain has to be credited to safe operations.

Another encouraging item was the number of clubs that received Flying Safety Awards from the Federal Aviation Agency. Forty-nine out of 108 clubs received awards.

Probably most convincing is the improved accident rate. Since no accurate record of flying hours was kept until recently, the past two years must be used for this comparison. For 1964, the aero club accident rate showed an improvement of 23 per cent over 1963.

WHO GETS THE CREDIT?

To what can we attribute the improvements that have taken place during the past couple of years? For one thing, a great deal of emphasis has been placed on factors contained in an article in this magazine for December 1963, "A Hard Look at Aero Clubs." Then there has been a tougher Air Force policy, generally expressed as "Shape up or close up." As a result, many deficient or marginal clubs which didn't "shape up" are out of business.

Probably the requirement that aero club accidents be investigated and reported, just like military accidents, has had a beneficial effect. At the very least there will be records which can be used to spot deficiencies and trends, a valuable tool for preventing accidents.

Another important factor in the improving aero club accidents picture is the effort put forth by the people in charge of aero clubs at the USAF Military Personnel Center, Randolph AFB. They've done much to get some organization into the aero club program. Their latest revision of AFM 215-4 Air Force Aero Club Manual is a blueprint for safe and efficient aero club operation. Their monthly poop sheets mailed to all clubs contain good information. In addition Major Jim Kiser and SMSgt G. F. Pollock Jr. visited more than 50 clubs last year. When they recommended that a club be shut down that generally was exactly what happened.

A big share of the credit must go to base commanders and the clubs themselves. The decline in number of accidents reflects better supervision by commanders and improved management on the part of club officers and managers.

OTHER SIDE OF THE COIN

All of the above is very encouraging but there are some blemishes on the other side of the coin. Last year there were 69 accidents and incidents, five fatal accidents and eight deaths. Cause factors are equally discouraging (Fig. 2): 52 were due to pilot factor. This far outnumbered all other factors combined. An encouraging thing was that only one accident was attributed to maintenance deficiency.

That pilot factor predominates is hardly surprising in a program comprising pilots of varying experience and competence (nearly half are students). Some accidents resulted from poor judgment, although it is often difficult to differentiate this from lack of experience. Others were brought about by poor technique, some by foolishness, some directly attributable to the pilot's low experience.

While we're on the subject of pilot factor we may need to look backward from the accident for the real factor. Were the actions of the pilot at the controls really to blame? It is obvious some students have been poorly instructed. So even if an accident is labeled Pilot Factor, it pays to take a closer look if we're going to prevent these in the future.

Among accidents that occurred last year were several ground loops and similar mishaps. Pilot factor? Yes, but was the student adequately trained in either avoiding crosswind conditions or in coping with them?

Cockpit unfamiliarity: Did the instructor, or check pilot, ensure that the person he turned loose with an airplane was intimately familiar

Fig I

USAF AERO CLUB STATISTICS

Year	Nr Clubs	Nr Members	Nr Aircraft	Total Acdts	Fatal Acdts	Fatalities
1960	180	15,000	814	75	10	15
1961	175	15,000	824	139	15	26
1962	159	10,743	760	109	10	21
1963	135	10,168	717	67	12	18
1964	108	9,428	547	47	5	8

Fig II

AERO CLUB ACCIDENT/INCIDENT CAUSE FACTOR - 1964

Pilot	52
Maintenance	1
Materiel	12
Weather	3
Undetermined	1

with all the switches, knobs and levers? Obviously not.

Poor judgment: do instructors have the courage to recommend dismissal from the club of those individuals who demonstrate poor judgment and recklessness?

By far the greatest number of accidents last year occurred during landing. Nine of these took place with the gear up (all in the T-34), some because the pilot couldn't handle the wind, others in which control was lost for various reasons.

There were several mishaps due to cockpit unfamiliarity. For example, a student inadvertently put the fuel selector in the off position. In another the pilot grabbed the gear switch instead of the flap switch.

Then there were those in the damn-fool category. A sorry example was the fellow who buzzed a lake several times, much to the discomfort of boaters and water skiers, since at least three passes were below 50 feet. He then dusted off a camping area. Then apparently he tried a Split S and sucked it into a spin. The aircraft crashed and sank in 35 feet of water—the pilot was killed. This man had 500 hours and a commercial rating.

Whether this pilot had a history of such recklessness is unknown, but we're reminded of another case that occurred awhile back. This man ran out of gas trying to stretch a flight beyond the endurance of the aircraft. Although he was over mountainous terrain at the time, he lucked out and found a suitable spot for a forced landing. Sometime later this same individual took an aero club plane, flew to a nearby field and picked up two unauthorized passengers whom he transported to a city some 500 miles distant and returned them the following day. He didn't realize, however, that an employee of the aero club was at the airport where he picked up the passengers. This man reported to the club officers and the offending pilot was expelled from the club. Action taken after the first indiscretion would have prevented the second.

BETTER RECORD POSSIBLE

As indicated early in this article there has been tremendous improvement of the aero club safety record. But that doesn't mean we're in free. As of the end of March this year there were seven accidents and 17 incidents. In one accident there were four fatalities. To keep the accident curve going downhill, here are some recommendations from the aero club project officer in the Directorate of Aerospace Safety:

- Higher standards on the part of instructors. (FAA has agreed to flight check instructors at least once a year, more often if desired and workload permits.)
- Strict adherence to directives.
- Continued improvements in club management.
- Continued emphasis on maintenance. (Better inspection last year would have prevented incidents attributed to materiel failure.)
- Safety education programs at each club meeting.
- Clubs subscribe to General Inspection Aids Summary, FAA AC No. 20-7A, $1.25 a year, $1.75 foreign. This package includes the annual summary and 11 copies of the monthly General Aviation Inspection Aids. Another worthwhile publication is FAA Aviation News, $1.50 U.S., $2.00 foreign. These publications can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Flying is generally considered to be hazardous. Most of these hazards can be removed for a club operation with proper management and good discipline and judgment on the part of members. In fact, we think light aircraft are a lot safer than your car. Anybody for the freeway? ★

Bug smashers can be safe, but not when such items as this concrete block are overlooked during walk-around. It flew, to 50 feet, gear up, then ka-whop!

To show you that fiction is stranger than truth, we present a monologue titled...

The 45 DAY WONDER

No, Virginia, its not that flying in itself, is so relaxing; it just seems so because of all the pilot goes through beforehand.

Just for kicks, come with a 100-hour-a-year administrative type. First of all, if he wants to fly (and you know we would never turn down flight pay) he'd better show some interest. Early in the month, like the first day, he ought to call the scheduling section and make two things mighty clear:

1. He wants to fly.
2. The days he is available.

O.K., so far. He should follow this up with occasional calls to show that he is really available. Fact is, he should even drop in at scheduling whenever he can — the personal touch, you know.

Then, when he does get on the schedule he should do two more things:

1. Plan to fly.
2. Resolve to not be too upset when he doesn't get to.

Once he's scheduled he's in for all sorts of trouble.

The plane may break down, probably this won't be known until after he has left Base Ops for the flight line.

A high priority requirement can come up (sorry, didn't anyone call you?)

The other pilot had his flu shots two days ago and is on the critical list.

By golly you're right. This must be the closed runway.

Sorry to bump you at the last minute but a full colonel up in headquarters needs time and this is his last chance before a long TDY.

Weather just went below minimums.

The pilot on the morning flight put the plane on a Red X. That's right, there is no backup.

Somebody got a flap with the fork lift.

. . . But suppose the schedule

holds. He shows up at Base Ops on time — a little early actually — because he always flys with guys who have to leave the office late.

Good thing he's early. The contractors who make a good living at perpetual remodeling have things in a real mess. Viz in the flight planning room is almost zero because of the dust. The whole room shakes as some clown with a jack hammer works his way along the floor. Flight plans, clearances, performance cards, charts, maps, SIDs — all these are missing! They've been protectively hidden from the dust and the pilots. The dispatcher is on the phone. When he finishes explaining the procedure for getting on a military flight he will get the paperwork needed for flight planning.

Abort? NEGATIVE! It'll smooth out.

Ah-ha! The NOTAMs are finally located — inside the latrine door — had to get things out of the dust. But the dispatcher can't be criticized, especially when he shakes his head and remarks how difficult it is to work a shift under such circumstances.

Finally, behind already by the clock, our pilot's ready — oops, almost.

Gotta get a local kit.

Gotta read the PIF — at least sign it.

Gotta sign some sort of sheet that says, in effect, the pilot certifies he is responsible for anything that might possibly go wrong.

Gotta get the weather extended.

Gotta get the crew bus driver out of the coffee shop.

Gotta change the SID. Can't use that departure with the VOR out . . . How would he know it's been out four days?

Gotta get briefed on the new form that shows passenger miles flown . . . of course it's mandatory.

At last.

Hi, Sarge, how's the bird?

What's that — gone after a power unit . . . hope he expedites . . . We've got to RBI if we miss take off time by over 15 minutes.

Oh, hi, glad to meetcha. You got on the clearance in Ops? Good. Yes, you can log nav time . . . four hours, I hope.

Aren't you Sergeant Foster? We got Airman Ryan on the clearance for engineer. O.K. But, remind me to call in the change when we taxi out.

Yes sir, Colonel, if you wouldn't mind. I'll get the inside.

SARGE!

Yeah, I wanted you. Both fuel gages inop, or haven't we been refueled?

Awright, but get 'em here on the double . . . better get oil, too.

No, I wasn't talking to anybody in particular. I was just wondering how we ever launch a missile when we have such a helluva time trying to get a Gooney Bird off the ground.

. . . Well, we got fuel and oil, and everybody on board, and the door closed, and the exterior, and the interior and the before starting checklist, AND the fireguard. Men, rap on wood, finger your beads, bow your heads — anything you feel might help — and TURN ONE!

Excellent start, men. Only two small backfires . . . that's right, Sarge, don't let 'er die, whatever you do. TURN TWO!

Hallelujah, they both run! Get the after starting, before taxi and taxi check. Wave the chock puller back . . . c'mon, baby.

Run-up check — and Sarge, be generous on those mag checks. This is my 45th day. If we don't get off today, I go non-current.

What's that, Colonel? Oh, sure, what'm I doin'? Trying to set the altimeter by turning the artificial horizon cage button.

Too bad, Colonel, if we ever land we'll never get off again.

Oh, ha-ha, right one shakes a little. No problem. Drop is 80 and 100. Naw, Sarge, I read 50 and 60. Just looks more to you because of the angle. You've heard of parallax? Besides, we're light. Got beaucoup performance when it's cold like this. Don't worry, Colonel, they always smooth out at takeoff power. Try hittin' the mike on the window sill, sometimes that works.

By golly, you're right. This must be the closed taxiway, probably why they've got those barricades up ahead. Well, never be too proud to make the 180 . . . that's an old fly safe axiom. Let's see. Yeah, you're right. If we turn here ought to get to the active. Traditional I guess that this time of year some contractor is ripping up a section of the old airdrome. They probably got the world's best lobby.

Let's see now, SIF on Code 3, Mode 06 — or is it Mode 3, Code 06? Doesn't matter . . . anyone know where they've located the controls in *this* one? Well, imagine that, way over there. Congratulations, Colonel, doubt if I'd ever have located it.

O-o-o-oh kay, Sarge, let's get the rest of the checklists out of the way.

Colonel, tell 'em we're ready.

Tell 'em we're rolling.

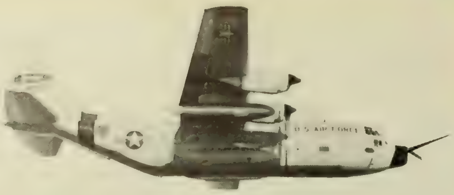
Whats that, abort? NEGATIVE! It'll smooth out. Ease the power back a touch on the right one — nurse 'er, Sarge, nurse 'er. Atta boy. See, it's not backfiring now. Nice goin', Sarge. Yeah, Colonel, sure, Gear Up.

Boy, sure hope we can keep air borne for four hours.

Howzat? Yes, sir, I'd like to shoot some landings, but boy, we don't want any aborts. Sarge, ease 'em up to max. Let's see how they . . . oh, oh, pull 'em back. Too bad, Colonel, if we ever land we'll never get off again. Tell you what, we'll get some practice approaches at altitude, intercept bearings, enter holding patterns, do a little practice airways flying . . . fella should keep up on his airwork too, ya know. Besides, the navigator has gotta get four hours too.

Howzat? No, sir, you can't volunteer for Category Three . . . I— a friend of mine tried. The best bet now is 45-22 and rottsa ruck! ★

MORE MUSCLE FOR RESCUE



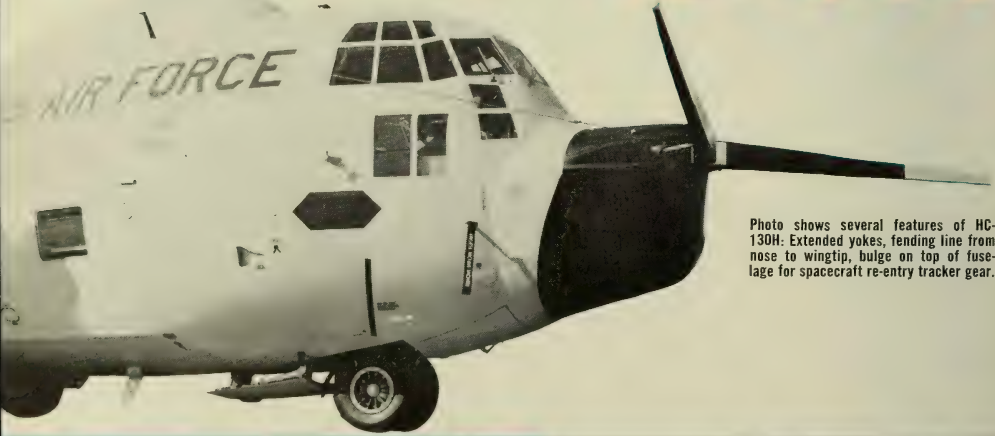
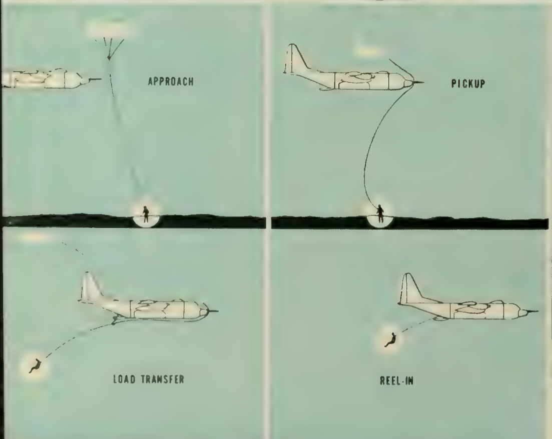
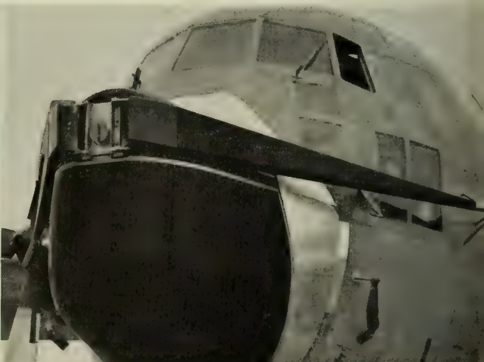


Photo shows several features of HC-130H: Extended yokes, fending line from nose to wingtip, bulge on top of fuselage for spacecraft re-entry tracker gear.





During normal flight yokes fold back, as above. Pilot extends them when ready for an aerial recovery. Sky anchor can be seen at apex.

A new Long Range Aerial Recovery System designed to perform a variety of jobs ranging from rescue work to support of manned space launches and aerospace hardware recoveries will go into operation late this year with Air Rescue Service.

Heart of the system is the Lockheed HC-130H, a C-130 fitted with special equipment and more powerful engines than its predecessors. These engines, Allison T56-A-15 turboprops, are rated at 4591shp, although output is limited to 4200-shp. Special equipment includes a recovery system developed by the Robert Fulton Co., an overhead delivery system, multiple-tube flare launcher, reentry tracking system in a dome on top of the fuselage, and other electronic gear.

The most apparent part of the recovery system is a nose-mounted yoke — a pair of 15-foot aluminum probes mounted to form a V on the nose of the aircraft. A catch mechanism called the sky anchor is located at the apex of the yoke. The sky anchor locks onto a nylon lift line stretching from the person or object on the surface to be picked up to a balloon. Normally the yoke is positioned flush with the fuselage. When the pilot desires to make a pickup he extends it by use of a control in the cockpit.

In the event of a miss, the lift line is protected from the propellers by fiberglass fending lines 3/8 in. in diameter stretching from nose to wingtips.

Once the lift line is caught, it is up to the crew in the rear compartment to get the recovered person or equipment aboard. The lift line trails from the yoke under and behind the aircraft. This is hooked, the line pulled onto the ramp and secured. Then through a series of line transfers to winch assemblies, a snatch block and davit, the package—man or equipment—is reeled in and hoisted aboard.

Although the aircraft is unmistakably a C-130, there are a lot of differences: some, the nose yoke and fending lines, are evident, as is the blister on top of the fuselage. But the big difference is under the skin — the reentry tracking system; scanning stations on each side near the front of the rear compartment; a pair of 1800-gal. internal fuel tanks; an equipment bin for storage of recovery kits and other rescue gear. Redundancy is the word with the communications equipment — there are two of almost everything.

The HC-130H also features an overhead delivery system. The track runs along the top of the rear compartment to the aft cargo door. The 10-tube flare launcher is located in the door, which has a track on the outside that mates with the interior track to extend the delivery system beyond the ramp when the door is open. The winches are mounted on the floor near the aft end of the rear deck and the davit is stored nearby.

Various configurations are available according to the mission. Here are some possibilities:

- Visual search and recovery — radius of operation, 1500 nautical miles, search time one hour, two recovery operations.
- Orbit — radius of operation, 1000 nautical miles, orbit at optimum altitude for eight hours, two recoveries.
- NASA search and recovery — radius of operation, 2200 nautical miles, search time one hour, three recoveries.

Range was based on the distance between land bases for recovery of Apollo crews.

Normal crew is 10, two pilots, navigator, two flight mechanics, radio operator, two loadmasters, two pararescuemen. Provisions are made for augmentation by an additional pilot, navigator and radio operator.

A possible rescue mission, one pilot down in the water, would go something like this:

The survivor is located and a recovery kit is dropped into the ocean near him. The kit will contain a six-man life raft, a couple of helium bottles, a suit with an attached harness, 500 feet of 4000-lb. test nylon lift line and a 725-cu. ft. balloon which the survivor will inflate to carry the lift line aloft.

The man will get into the raft, put on the suit, fill the balloon with helium and send it aloft. The rest is up to the crew aboard the aircraft. The pilot's job is to intercept the lift line. A 100-foot section of the line near the top end is marked with pennants (lights for night recoveries). He flies upwind toward the lift line and extends the yoke. When the yoke hits the line it is locked into the sky anchor at the apex of the yoke and the man on the water is lifted practically straight up, the shock being absorbed by the nylon line. He is then gently hauled aloft and reeled into the aft section by the winch. He'll never forget that ride from brine to plane — the aircraft will be flying at 120-140 knots TAS nearly 500 feet above the surface.

Recovery kits differ depending on the number of persons to be rescued. For more than one person the kit will contain four helium bottles and 625 feet of 6000-lb. test line, (two six-man rafts for water recovery). The balloon will be larger — 1200 cu ft. Dual recoveries can be made with two suits fastened together.

Operational limits for recoveries are, wind up to 30 kts., temperatures +120°F to -65°, international sea state 3 (wind 13-18 mph, waves 2-3 feet high). There should be no obstacles over six feet high within a 50-foot radius and none over 50 feet high immediately adjacent. Maximum altitude is 10,000 feet; pickups can be made on a slope of up to 25 per cent.

Air Rescue Service is to receive the first HC-130H in July and replacement of HC-54's will be on a one-for-one basis. Crews assigned to the test program will form the nucleus of instructor crews at ARS recovery units where the aircraft will be assigned. ★

Malfunction Analysis

By Norman E. Borden, Jr., Operating Instructions Engineer
Pratt & Whitney Aircraft, East Hartford, Connecticut

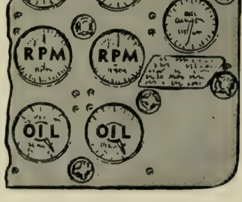
Early recognition of an engine malfunction followed by prompt and proper pilot action may be all that is needed to avert an accident.

As almost every pilot knows, literally millions and millions of flying hours have conclusively proved that today's jet engines are the most reliable power plants which have ever been built for aircraft. But the intrinsic dependability of the jets can boomerang and become a hazard if it is allowed to lull flight crews into complacency. The record of the jets is so extraordinary that many pilots take trouble-free engine operation practically for granted. Nevertheless, jet engines are still machines. As such, they are subject to occasional malfunction or, in rare instances, even to complete engine failure. Therefore, the possibility of engine difficulty in flight or on the ground cannot be ignored.

A controllable malfunction could conceivably become a serious emergency because of the attitude "it can't happen to me." This has, in fact, occurred many times as attested by tales of incidents which have been recorded from time to time on the pages of AEROSPACE SAFETY magazine. The axiom taught by such incidents is obvious. It behooves the pilot and crew who would meet trouble successfully to know in advance how to handle any situation which might arise in order that they may react almost instinctively when occasion demands.

Fortunately, jet engines actually speak a language. Talking through their instruments to pilots, flight crews and ground maintenance personnel who will listen by frequently checking and correctly interpreting the engine instrument readings, the jets communicate about how they are doing and they usually forecast a major malfunction well in advance of serious trouble. It is characteristic of axial compressor turbojet and turbofan engines that a change in the operating condition of an engine which causes a variation in the reading of any one of the four primary engine operating instruments (exhaust gas temperature or EGT, compressor RPM, engine pressure ratio or EPR and fuel flow) will also cause the other three primary instruments to vary. Conversely, when only one of the four primary engine instruments, by itself, indicates an erratic or abnormal reading, the cause is most likely an instrumentation system malfunction.

These four primary instruments (EGT, RPM, EPR and fuel flow) should be monitored simultaneously because the interrelationship of their readings at any given time provides the key for determining engine condition and diagnosing incipient trouble. Fuel pressure, oil pressure and oil temperature are not necessarily interrelated and may be monitored individually. A knowledge of what may be wrong when trouble comes will provide the best possible clue to the right course of action in each instance. Many situations can be quickly analyzed and timely measures taken if an engine's malfunction symptoms are understood. On the other hand, misinterpretation of apparent abnormal engine operation and subsequent improper corrective action may possibly cause a more serious situation than was present in the first place.



The guide to malfunction symptoms which follows represents a few, but far from all, of the circumstances which might occur to the afterburning engine, or engines, with which a fighter-type aircraft is powered. With the exception of malfunctions relating specifically to the afterburner, the same symptoms and their probable cause will normally also apply to non-afterburning engines installed in multi-engine bombers, tankers and transports. As an example of this, a similar, much more complete list of symptoms, their probable cause and the recommended action appears in full color in Section VII of T.O.'s 1C-135(K)A-1 and C-135F-1. The abbreviated list which follows here and the list in Section VII of the KC-135 and C-135 Flight Manuals were prepared by the author. The latter, being more comprehensive, is recommended for study by all who are interested, no matter what type of jet-powered aircraft they may be flying. Both lists are for axial single and dual compressor turbojet and turbofan engines manufactured by Pratt & Whitney Aircraft.

These malfuction guides are not intended to serve as maintenance trouble-shooting charts. To the contrary, the malfunction symptoms mentioned are only those which will be apparent to the crew in the aircraft. Similarly, the action recommended is only that which the pilot or crew may initiate themselves. Sometimes the only action a pilot can take is to shut the engine down or terminate the flight as soon as possible.

In the event of abnormal engine operation of any kind, the incident should be reported by an intelligent, accurate notation in the Form 781. Whenever possible, the engine instrument readings before and after the malfunction should be noted. Properly recorded engine discrepancies make for more positive malfunction analysis on the ground and for faster, better corrective maintenance.

Possible Malfunctions of the Basic Engine

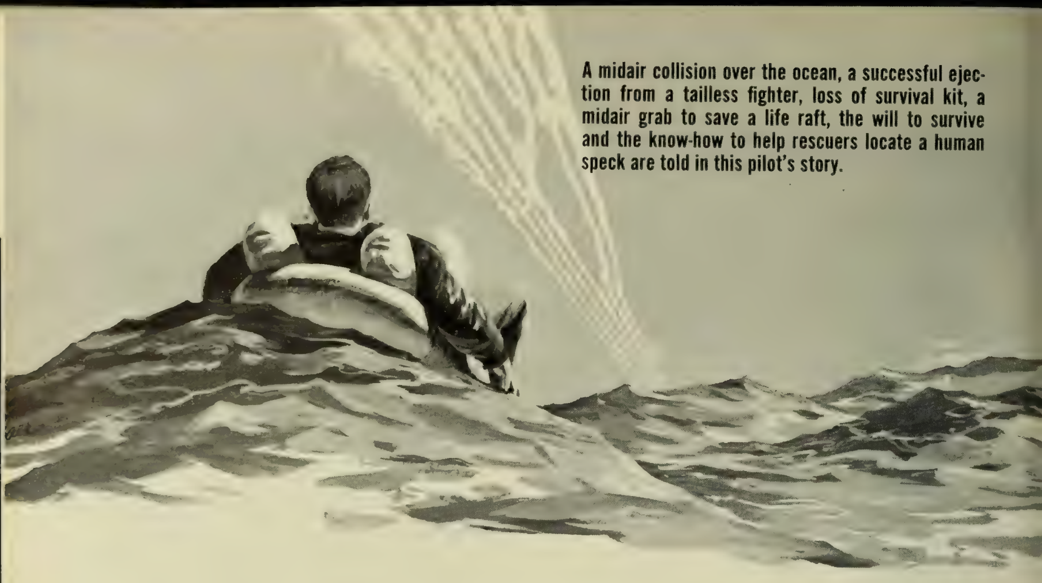
CONDITION	PROBABLE CAUSE	ACTION
TAKE-OFF ENGINE CHECK EPR at full throttle higher than computed. EGT, rpm and fuel flow higher than normally experienced for prevailing conditions.	Possible miscalculation, or use of incorrect temperature when determining take-off EPR Engine trimmed too high Possible, but not probable, fuel control malfunction	Recheck take-off EPR for prevailing ambient conditions. Continue with the take-off at the pilot's discretion, throttling back, if necessary, to avoid exceeding maximum allowable values for EGT, rpm and that computed from curves or tables in the aircraft Flight Handbook for the maximum EPR at the prevailing ambient conditions.
EPR lower than computed minimum for full throttle operation at prevailing ambient conditions.	Engine thrust deterioration due to deposits of foreign material on the compressor blades	Abort or continue the take-off at the pilot's discretion, depending upon the circumstances. Report engine for up-trimming or field-cleaning.
IN FLIGHT Drop in EPR, compressor stall (slight, snorting or very pronounced), possible reduction in fuel flow and, lastly, a rise in EGT as the condition continues. Rpm may or may not fluctuate, or it may drop if the condition continues.	If condition occurs during suspected inlet icing condition, possible accumulation of ice on engine air inlet section. Particularly if accompanied by compressor stall, may indicate engine ingestion of ice, with or without damage to the engine. Possible malfunction of automatic actuating system for the air inlet duct anti-icing equipment Engine ingestion of foreign object, such as a bird, with or without damage to the engine. If stall and/or high EGT continues, suspect compressor damage. If during or following an acceleration, suspect possible airbleed valve malfunction, particularly if stall disappears after engine has stabilized and instruments return to Normal.	If the condition occurs when ice might form in the engine inlet, turn engine anti-icing system "On." An increased throttle setting and/or a slower airspeed will increase the anti-icing heat and decrease the rate of ice formation. Observe EGT closely to avoid exceeding the prescribed limits. *The engine anti-icing system prevents the formation of ice and is not a decier.* Under the most severe conditions, it may be necessary to change the aircraft altitude or to locate atmospheric conditions that are relatively free of icing until the accumulation of ice has cleared from the engine air inlet. As soon as the engine commences to operate normally, the icing conditions may be safely re-entered. If a persistent stall occurs during or following acceleration and a stuck airbleed valve is suspected, reduce throttle setting and accelerate slowly. This may or may not be effective. **CAUTION:** *If internal engine damage is suspected or if EGT or compressor stall cannot be controlled, land as soon as possible, using the minimum thrust required to sustain flight.*
EGT too high, EPR lower than Normal, all other instruments approximately Normal	Excessive airbleed from engine due to: (1) Overboard airbleed valve stuck open, or (2) Excessive leakage in the aircraft bleed system.	Anticipate a higher than normal fuel consumption for the thrust produced until the condition can be corrected. Reduce the throttle setting, if necessary, to avoid exceeding the allowable maximum EGT. If overtemperaturing cannot be controlled, land as soon as possible.
Compressor stall during deceleration, often followed by a rumbling sound in the air inlet duct. Rise in EGT when condition persists.	Intercompressor overboard airbleed valves do not open during deceleration, due to: (1) Bleed governor schedule set too low, or (2) Bleed governor or bleed valve malfunction.	Increase airspeed to correct stall condition. Try switching to the emergency fuel system to control excessive EGT manually by the throttle setting. If overtemperaturing cannot be controlled, land as soon as possible.
EGT near Normal or low. Rpm, EPR and fuel flow low. Engine continues to operate.	Fuel control malfunction	Unless the condition is serious, no action is necessary except at the pilot's discretion. Report circumstances on Form 781.

CONDITION	PROBABLE CAUSE	ACTION
IN FLIGHT (Continued) Sudden drop in EGT, RPM, EPR and fuel flow. Complete loss of thrust.	Simple flameout, particularly when flying in turbulent air, resulting from upset airflow at the engine air inlet or within the compressor, itself. Flameout resulting from fuel flow interruption, possibly from running out of fuel. **NOTE:** Ignition operation should be for as short a duration as possible.	Attempt an air start. if this fails, attempt an air start on the emergency fuel system. Check fuel in tanks. Switch tanks, if necessary. Check position of emergency fuel shutoff valve. If cause was a simple flameout resulting from flying in turbulent air, try increasing the airspeed to prevent recurrence. Also, the ignition may be left "On" for short periods until the turbulent area is penetrated. This will serve to relight the engine automatically, in some cases.
Abnormal oil pressure	If the oil pressure gage reading is too *high:* Oil strainer is clogged, Oil pressure relief valve is not by-passing. If the oil pressure gage reading is too *low:* Oil level in oil system is too low, Oil line failure, Oil seal or bearing failure, Oil pump failure. **NOTES:** (1) A fluctuating oil pressure might be caused by any of the above causes. (2) Although a high, low or erratic oil pressure is frequently caused by a malfunction of the oil pressure transmitter or the oil pressure indicator, *it would not be safe to assume positively that this is the case.*	Normal oil pressure is 40 to 50 psi for most engines. Refer to applicable Flight Manual. Oil pressures between 35 and 40 psi are undesirable and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Oil pressures below normal should be reported on Form 781, and should be corrected before the next take-off (i.e., do not practice touch-and-go landings). *Oil pressures below 35 psi are unsafe and require that a landing be made as soon as possible, using the minimum thrust required to sustain flight.* **CAUTION:** *If the oil pressure drops to zero and remains there for 15 seconds, or more, reduce the throttle setting to the lowest position required to sustain flight and prepare for the possibility of a seized engine within 2 to 4 minutes.*

Possible Malfunctions of the Afterburner

CONDITION	PROBABLE CAUSE	ACTION
As soon as the afterburner is turned on and ignited, EGT spirals upward. EPR will also be high. The condition may be (but not necessarily always) accompanied by compressor stall. On J75 engines, large drop in RPM when going into A/B with only a slight rise in EPR and EGT.	Afterburner nozzle fails to open or does not open completely when the afterburner is turned on and ignited. This might be caused by: (1) Binding of afterburner nozzle actuator pistons, or (2) Malfunction of afterburner exhaust nozzle control (ENC).	Discontinue afterburning immediately by deenergizing the afterburner switch in the throttle quadrant. If EGT exceeded the allowable limit, report the maximum temperature reached and the time that the temperature was overboard, on Form 781. Although the nozzle might open successfully if another attempt is made to light the afterburner, extreme caution should be used to avoid damaging the engine.

CONDITION	PROBABLE CAUSE	ACTION
AFTERBURNER (Continued) Conditions similar to those above, except less pronounced. EGT and EPR high as soon as afterburner is ignited. The condition may possibly be accompanied by compressor stall.	Afterburner nozzle is slow to open after afterburner is ignited. This might be caused by: (1) Afterburner "Off" and "On" operation repeated too rapidly, (2) Afterburner exhaust nozzle control (ENC) malfunction, (3) Afterburner nozzle improperly adjusted.	If the afterburner has been used intermittently, especially if a compressor stall condition has become aggravated by the afterburner having been repeatedly turned "Off" and "On," allow more time between shutting down the afterburner and commencing the next afterburner relight. The interval during which the afterburner is "Off" should be at least one minute. If the condition continues, further use of the afterburner should be at the discretion of the pilot.
Afterburner does not light up after afterburner is turned on. Condition will be noted by a lack of response of the aircraft and a sudden drop in EPR as the afterburner nozzle opens.	On J57 and J75 engines, fuel squirt from afterburner igniter and afterburner fuel flow from spray bars improperly timed, due to a drained afterburner fuel manifold Afterburner igniter malfunction Afterburner fuel control improperly adjusted Burner pressure line from diffuser case to afterburner meter leaking (possible but not common)	After leaving the afterburner "On" for 8 to 10 seconds, turn "Off" for 2 seconds, then "On" again for another lighting attempt. This technique gives good results because it changes the sequence of the igniter squirt and the afterburner fuel flow. The success of an afterburner light depends upon the igniter being timed to squirt when the afterburner fuel pressure in the manifold is increasing. If the squirt comes too late, the fuel/air ratio is too rich. If the squirt comes too soon, the ratio is too lean. When a fuel-circulating type of afterburner igniter is employed, the best recycling period between the first and second attempt to obtain a light is 3 to 5 seconds.
EPR too high during afterburner operation. Afterburner nozzle fully open.	Afterburner fuel control set too high Malfunction of fuel pump transfer valve or transfer valve actuator	If prior to take-off, abort or continue the take-off at the pilot's discretion. If the afterburner must be used for take-off, the take-off should be made at a reduced throttle setting, when possible, to maintain EPR within limits. If during flight, discontinue afterburning at the pilot's discretion.
Afterburner flameout in flight. **NOTE:** EGT and fuel flow will drop if afterburner nozzle remains in the open position after flameout.	An afterburner flameout in flight might result from any one of various causes, the most likely being incorrect fuel flow to the afterburner.	Try to relight the afterburner at a lower altitude and/or a higher airspeed.
EGT, EPR and fuel flow lower than Normal after shutting down the afterburner.	Afterburner nozzle stuck in the open position	Retard the throttle and then advance it again to the desired setting. This procedure will sometimes cause the afterburner nozzle to close. If the afterburner nozzle cannot be made to close completely, continue the flight at the pilot's discretion. ★



A midair collision over the ocean, a successful ejection from a tailless fighter, loss of survival kit, a midair grab to save a life raft, the will to survive and the know-how to help rescuers locate a human speck are told in this pilot's story.

Four Miraculous Hours

By Capt Hosea L. Skinner, 3615 Pilot Training Group, Craig Air Force Base, Ala.
(Written while an FSO student at USC)

Takeoff was at 0533. My wingman and I were to join the flight of six RF-101 Voodoos that were just approaching the island base and continue with them to our new station overseas. The climb and join-up were routine, and so was the first refueling more than 200 miles east. Then the climb back to 35,000 feet, the spreading out into ferry formation, and the long cruise climb toward the next refueling point.

As the flight leader was making his position report over the Coast Guard's Ocean Station vessel, I routinely looked at my left to check the position of my wingman. Surprisingly he wasn't there. I looked up, down, and behind, and still no wingman. As I swung my head back to the right I glimpsed over my right shoulder the nose of the biggest RF-101 in creation. Before I could react he gently slammed into my right upper fuselage. It sounded like the breaking of small boards, like the smashing of an orange crate. Then, complete chaos.

The tail of my bird was broken off and I started a backward tumble. Sitting foward of the center of rotation, I was held firmly in my seat, and during the tumbling I saw the other bird break in half and explode in a violent ball of orange fire. After six or eight tumbles my aircraft stabilized in a loose left spiral modulated by a fairly rapid left roll. Nothing on my instrument panel indicated problems . . . no fire warning lights, no generator out lights, no hydraulic warning lights, all needles in the green . . . nothing out of the ordinary. I could hear the other members of the flight now. "Look, they've had a midair!" "Lee, get out! Get out!" "Mayday! Mayday! Mayday! This is High Flight Charlie! We've lost two aircraft directly over the Ocean Station. Mayday! Mayday! Mayday! This is . . ."

My control stick was like a post driven in the cockpit floor, and for some reason I couldn't find the airspeed indicator. The continuous clamor of voices on the radio, coupled with the uncontrollable gyrations of my airplane, made the decision to eject an easy one. I keyed my mike and said, "I'll be getting out in a couple of thousand feet." Nobody heard me.

At about 34,000 feet I jettisoned the canopy and was surprised that no great blast of air hit me. Everything was peaceful and quiet, almost unreal. My navigation kit fell across my right leg, and I picked it up and tossed it overboard. Then, as my bird passed through the upright I ejected. I have no real memory of the ejection except that it seemed to happen jerkily, as do the old movies. Sometime during the ejection process I lost my helmet, but didn't realize this until much later. The seat and I separated, almost. My seat type survival pack was cinched to my parachute harness by two nylon straps, and the end of the left strap had flapped out and wrapped over, back under, and behind the left ejection handle. The task of loosening the strap looked simple, but with the seat and me flailing around in the airstream it was impossible. I reached for my knife, but it was gone. I reasoned, somehow, that in times of stress the supercharged human system was super strong — and perhaps it is, but I couldn't break the strap.

After what seemed an infinity it suddenly occurred to me that if I happened to be under the seat when my parachute automatically opened at 14,000 feet I'd had the course. It would rip me in half and keep right on going. Now what? I had to get above the seat, so I stuck one foot into the bottom of the seat, arched my back and stuck my arms and the other foot widespread into the airstream so that I'd rotate above the seat. As I passed through the horizontal I also passed through 14,000 feet. The next thing I knew I was hanging peacefully in the harness of the prettiest parachute in NATO. The ejection seat had broken free and was already out of sight below me. I began looking around, and saw both our aircraft crash into the ocean. Even in my peculiarly perilous position there was an unexplainable sadness about the death of the airplane. With his airplane goes a pilot's most precious contact with reality.

I sat back in my harness and looked down to check myself for damages. As I looked down blood spilled off my head onto my lap. I felt my scalp and got my hand covered with blood. Then nature took over and I forgot completely about my cut scalp and got on with my assessment of the situation. The chute and I were oscillating quite badly in the breeze, so I, as I had always been told by the survival specialists, pulled the risers to stop the oscillations. Immediately the chute collapsed. I turned loose the risers and the chute reopened, this time with a pop as loud as a shotgun. Frightened, I said, "To hell with it. I'll oscillate." Everything else seemed intact, so I pulled the lanyard that would inflate my life raft and let my survival pack fall down to the end of its 25-foot nylon lanyard. Then, as if not enough had gone wrong, the survival pack tore loose and plummeted seaward. As it tore loose it snapped the lanyard tight and the life raft, attached to the lanyard 15 feet above the raft, also tore loose and was thrown upwind from me. However, it inflated, turned over in the breeze, and floated back toward me. As it passed in front of me I grabbed it and held on for dear life.

About 20 miles away I could see the United States Coast Guard cutter sitting peacefully in that big, big ocean. It cheered me somewhat, for I was sure that rescue was not far away.

It seemed I hardly went under water on touchdown. After climbing in the raft and tying it to me, I looked up and knew the loneliest moment I will ever know. Thirty-eight thousand feet above me two of the eight arrow-straight contrails stopped abruptly, and the other six continued east without interruption. I knew that nobody had fuel enough to orbit and help in the ensuing search, but it was a terrible feeling . . . deep, painful, and transitory.

The little auxiliary survival packets on my underarm life jacket had medicine, flares, signal mirror, dye marker, shark repellent, and several other little goodies to provide the comforts of home. After washing my head with salt water and doctoring the two small scalp lacerations, I started keeping a chronological record that later entertained me immensely. When a Portuguese C-54 came over the horizon an hour or so later I knew that rescue was imminent, so I fired both my orange smoke flares, but the '54 made a left and then a right turn and kept going. It bothered me some, but strangely I was still sure that nothing bad would happen to me.

The surface winds were about 18 knots and the water temperature was 68°F — cool but not fatal. The Coast Guard cutter was busily steaming back and forth over the horizon, upwind, looking and searching. About an hour after the C-54 had come and gone, a WB-50 came charging over the horizon and continued out of sight downwind. The cutter also went from upwind to downwind, and 45 minutes later the WB-50 came back toward me. I threw out my dye marker, got my signal mirror working, and shortly the WB-50 was circling me and firing red flares to mark my position. Just over four hours after the collision the cutter put a longboat over the side and picked me up.

They had already picked up my wingman, and subsequent piecing together of the whole story brought out what seems to me as near a miracle as I've ever heard. After takeoff my wingman had not disconnected his zero lanyard, so on ejection at 38,000 feet he should have been killed by opening shock. He was still in the aircraft when it exploded, and that should have killed him. The loss of his helmet and oxygen mask in the ejection should have wiped him out from oxygen starvation. With only a summer flight suit and a light jacket on he should have frozen to death in the -69°F at 38,000 feet. And, when he lost his survival pack and his life raft he should have been impossible to find in all that water. In other words, everything was against him, but he survived. The most fantastic part of his survival is that the smoke from the flares I had fired had gone downwind and was directly over him when the WB-50 arrived. The WB-50 crew saw the smoke, went to it, and there was a very small floating object wildly waving a white scarf. To me —miraculous.

What did I learn about myself? I had always wondered how I would react under extreme emergency conditions, would I panic and completely drop the ball? I learned the answer to that in four of the longest hours of my life. ★

HOW NOT TO CELEBRATE THE 4th

He had paid good money for the firecrackers. But some had been duds. The fuses had fizzed, then gone out. The airman felt cheated. After he had shot off all the good firecrackers he still had the urge to do more celebrating. Besides, his son had been enjoying the fireworks.

Maybe they could still have some fireworks — homemade style. He and his son shook a small amount of the gray powder into a piece of paper. They then rolled the paper tightly around the powder. Gingerly they applied fire and a small explosion resulted.

Success!

If a little powder makes a small explosion, then it stands to reason that a more satisfying explosion would result with a lot more powder. Now for bigger and louder "firecrackers."

The self-styled pyrotechnists found a piece of half-inch galvanized metal pipe about four inches long. It had the general dimensions of a large firecracker and should be of satisfying size. They set to work. First they drilled a small fuse hole through the wall of the pipe about midway between the ends. They stuck a piece of tape over this hole temporarily to prevent powder from spilling out. Next they whittled a wooden plug and pounded it into one end of the "pipecracker." Carefully they opened the dud firecrackers and cleaned out the gray powder. When they had enough they poured it down the open end of the pipe. When they had a powder depth of about one inch they decided that should do it. They whittled another wooden plug for the other end. While his son observed from a few feet away the airman started to plug the open end by hammering the plug in on top of the powder. While he was hammering away with a ballpeen hammer the son voiced his curiosity, "I wonder if the pressure will make it blow—"

BLOOIE!

The blast tore off the middle, ring and little finger and about half of the palm of the airman's right hand. His son suffered slight lacerations of the left arm and cheek.

Neighbors drove the injured to an air station for first aid. They were subsequently taken to a general hospital for additional treatment. Later, under questioning, the airman explained how his plan had been disrupted by the premature explosion. Had he been successful in pounding in the second plug, he intended to insert a 12-inch powder filled plastic tube one-eighth inch through the fuse hole. He figured that the 12-inch "fuse" would provide adequate time to light the fuse and get a safe distance away.

Interrogation disclosed that he had no previous experience with explosives and was unaware of the fact that increased pressure could detonate the powder. ★

ABOUT USELESS THINGS

By Chaplain (Maj.) Frederick J. Ellis, Jr., Andrews AFB, Washington, D. C.

An old flyer once remarked: "The two most useless things in the world are the altitude above you and the runway behind you." I would like to add a third category to his list. I suggest as equally useless "The seat belt under you!"

The disadvantages of seat belts are their additional cost, the seeming inconvenience of buckling them each time you sit down in the car, and their annoying habit of seeking or shifting to an inaccessible spot under the seat or over the door sill. These and any others you can think of are far outweighed by the fact that they can save your life or the life of a loved one.

Why an expressed concern for seat belts in a chaplain's column? Because LIFE IS A DIVINE GIFT, given by Almighty God to man in trust and stewardship. No one has any right to do anything with life other than to use it in a manner pleasing to God.

Therefore any deed or misdeed that results in a lost or maimed life is contrary to the will of God and a breach of a sacred trust. Deliberate risk of life or inadvertent avoidance of a precaution, such as a seat belt, which will help safeguard a human life is not only foolish but immoral as well.

Seat belts are therefore not "extra" equipment but are by their very existence a mute reminder of a moral issue. ★

Missilanea

SUPER VISION? As the investigating officer walked out of the room after signing the accident report, one fact remained clear. The real cause of this accident was people — supervisors were not supervising. A stage 2 missile tank ruptured because of a negative pressure buildup. The negative pressure was caused by fuel leaking from a quick disconnect at a very high flow rate and the alleged improper action of an airman when he changed the position of the fuel tank vent valve.

Preparation for the download had proceeded normally, with an officer supervising the operation over the communication net. He had in his possession a copy of the approved checklist to verify that all required steps were being accomplished. It is interesting to note here that the supervisor was using T.O. 21M-HGM-25A-CL15-1 (Download), which was proper for this particular operation. But the two airmen in the equipment terminal were using T.O. 21M-HGM-25A-CL12-1, for uploading, in lieu of the approved checklist for downloading.

As the leak developed at the probe in the silo, a call for assistance was made to one of the airmen in the equipment terminal. When the airman arrived at the silo, he observed fuel spraying from the missile. Thinking that the fuel running from the tank would create sufficient negative pressure to collapse the tank, the airman decided to continue with the checklist and pressurize the tank as an emergency solution to prevent implosion.

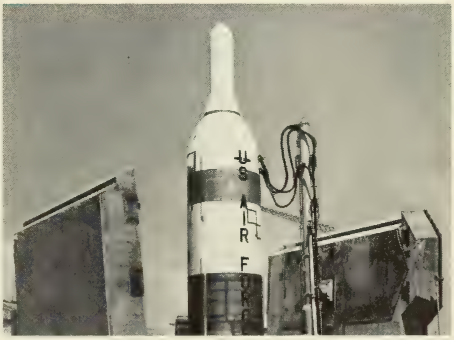
I think the frosty topping was applied to this particular accident when the airman's commander stated: "I am convinced that his actions were taken in good faith, but his error in judgment, due to lack of knowledge of the possible consequences of the fuel vent valve closure, resulted in the rupture." Acts of good faith and errors in judgment are certainly poor substitutes for good maintenance practices; e.g., following approved technical data, technical competence, supervisory control.

The investigating officer attributed the primary cause to materiel failure; viz., a dislodged "O" ring seal which allowed the fuel to flow freely from the tank. He determined the secondary cause as personnel error when the airman closed the fuel tank vent, increasing the negative pressure already created by the leaking fuel.

The Wing Commander did not concur with the primary cause factor as stated by the investigating officer. The commander considered the airman's action to be a deviation from good maintenance practices. He further stated that "although the airman's actions were made with good intentions, he failed to check with his supervisor prior to taking any emergency action. Thus, the best systems knowledge, skill and judgment were not utilized."

Response of higher headquarters to the comment made by the Wing Commander relative to the airman's good intentions was: "The actions of individuals, during emergencies in missile environments, in good faith and with limited knowledge, have resulted in tremendous losses. 'Good faith,' 'he thought,' or any of the other often used excuses are not acceptable in the face of the extensive and continuous flow of directives stating that technical data will be followed."

The question is not whether the rupture occurred prior to or as a result of the airman's actions, but "at what point was supervisory control lost and why?" My answer to this question would be that supervisory control was lost when the supervisor permitted deviation from the authorized technical order.



What was the authority for deviation from T.O. 21M-HGM-25A-CL15-1 in using T.O. 21M-HGM-25A-CL12-1 for download? How could the supervisor control the operation when some of the team members were using a different checklist?

You might say inadequate supervision. Another might say inadequate briefing. Still another might say insufficient know-how. In fact, all of these were touched upon to some extent in the investigation report. Also mentioned were such negative attributes as lack of common sense, deviation from tech data, and lack of good judgment.

The record shows many cases involving supervisory/personnel error. These all boil down to the fact that some supervisors are not putting enough supervision into their job of supervising. ★

Lt Col Adam F. Zalonka
Directorate of Aerospace Safety

THE MISALIGNED MISSILE

By P. M. Bowers, Minuteman Service News, Boeing Aero-Space Division, Seattle, Wash.

The missile was being removed from the launcher for recycling and had been hoisted completely into the fully-erected container when a packing nut failed because of hydrogen-embrittlement. The failure caused the left-hand actuator to break in two allowing the container to tilt and twist. The missile inside was moved out of position, breaking the stabilizing ring and coming in contact with the hoist sling rods and the top of the container. The incident occurred at approximately 2130 local time.

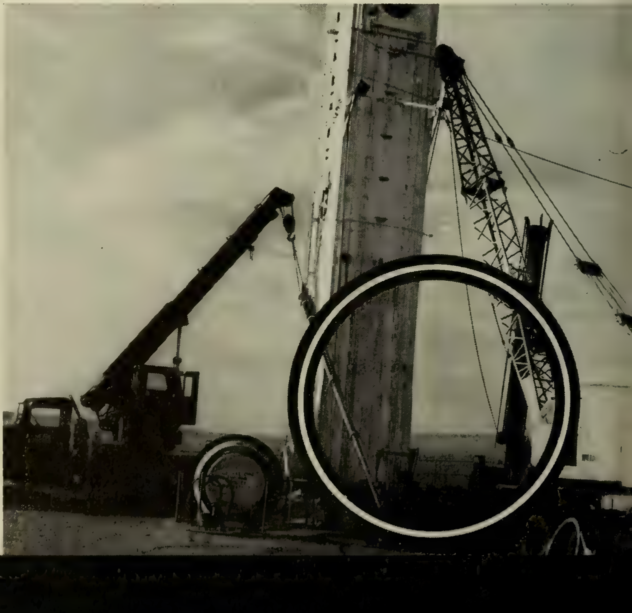
As soon as the incident was reported to Wing Headquarters, a survey team consisting of OOAMA and Boeing personnel (Boeing is the Assembly and Checkout Contractor for the Minuteman Weapon System) was dispatched to the site from OOAMA Headquarters. But there was little that this team or the SAC crew at the site could do until three heavy mobile cranes arrived some time later. The cranes were pressed into service as anchors for steel cables secured to the still-erect container to stabilize it against further displacement by anticipated high winds. Meanwhile, telephone contact was maintained with SAC and OOAMA Headquarters for approval of all recovery operations initiated at the site. With approval, an attempt was made with available equipment to reposition the missile slightly and lower it back into the launcher. This was halted when it became apparent that there was serious interference between the missile and some of the internal framework of the container. The fact that the stabilizing ring was broken was not known at this time.

Air Force personnel entered the container to evaluate the situation and work out corrective procedures. It was determined then that the stabilizing ring was broken and that the missile would have to be shifted back to its normal position relative to the container to permit its return to the launcher. To avoid the risk of damage to the missile from the application of correcting forces to points on the missile and the container structure that were not designed to withstanding such forces, the Air Force decided to obtain engineering assistance directly from The Boeing Company.

Boeing personnel at the site, with Air Force cognizance, had already reported the known details of the incident to their home office by 0830 the next morning and these had been brought to the attention of the

When the packing nut failed on a Minuteman transfer-erector hydraulic actuator, the resulting actions provided an excellent example of Air Force/Industry teamwork.

In photo at right cranes are used to stabilize against further shifting and high winds. Below, realignment was effected without missile damage and with no injury to personnel.



project engineers by the Field Service Unit, to which the report was made. The details were discussed during the day by means of conference calls between Boeing, OOAMA, SAC Headquarters, and 15th AF Headquarters. These were initiated by Ballistic Systems Division personnel who were at OOAMA at the time. The desirability of sending a Boeing engineering team to the site was considered during these conversations after it became apparent that the problem could not be resolved without special information unavailable at the site or in the standard supporting publications. By the time OOAMA formally requested Boeing to send such a team, four highly-qualified men had already been selected and given travel authorization — two from Structures Technology, one from the Design Project, and one, a metallurgist, from Materials Technology.

By 2100 the team had been flown to Wing Headquarters in an Air Force T-39. After a briefing by SAC personnel and a discussion of the Boeing proposals, the team was driven the 115 miles to the site, arriving at 0137 local time the following morning, less than 30 hours after the incident occurred and only eight and one-half hours after their presence had been formally requested.

The task of missile recovery was divided into three phases, with all activity proposed as a result of on-site decisions subject to approval first by on-site OOAMA personnel and then by SAC and OOAMA Headquarters by means of the communications network. Stabilization of the container, now designated Phase I, had begun as soon as heavy equipment, which had been dispatched from Wing Headquarters three and one-half hours after the incident, arrived at the site.

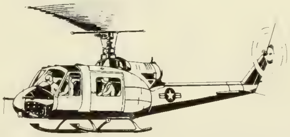
Steel cables had been attached to the container under-carriage and to the failed actuator attach point and anchored to the three mobile cranes that comprised the heavy equipment. By the time the Boeing team arrived, additional heavy vehicles and shoring timbers were at the site and were pressed into service for a revised stabilizing cable network.

Phase II called for bringing the missile back to a full vertical position, restraining uncontrolled lateral motion of the base, and installing a new stabilizing ring (one had been delivered to the site by helicopter). Phase III, lowering the missile into the launcher, had been attempted with minimum missile repositioning, but the procedure had been halted prior to the decision to bring the Boeing team to the site. The only continuing action at the site following cessation of missile lowering was to remove the broken stabilizing ring and take further steps to secure the container and the missile against displacement by expected high winds. Information as to the degree of displacement of the missile was sent to OOAMA Headquarters, with the opinion that lowering could be continued after the missile was realigned.

Realignment of the missile was begun by securing the missile base with several 5000-pound nylon cargo straps spaced around the launcher and attached to equipment room structure. By means of 1000-pound capacity portable winches attached to points on the missile and the carriages, the missile was moved far enough to permit installation of the replacement stabilizing ring. When the securing straps at the base of the missile were gradually released after the ring had been installed, the missile was properly positioned in the hoist sling rods and had adequate clearance from the sides of the container. Phase II was accomplished in approximately eight hours.

Phase III was completed in just under one hour, the lowering following the standard T.O. procedure except that movement was in short stages with a stop every five minutes for careful checks of alignment, clearance, and possible missile damage. Since the container was still out of alignment, the missile could not be lowered directly onto the base support ring. It was necessary for personnel to enter the bottom of the launch tube and swing the base of the missile manually in order for it to seat properly. The missile was safely seated on the receiver ring by 1714 and OOAMA and Boeing personnel were cleared from the site by 1733, slightly less than 48 hours after the incident occurred. The damaged T-E actuator was replaced the next day, the container was lowered, and the T-E was driven from the site.

The successful resolution of this unusual incident without damage to the missile or injury to personnel is a tribute to the quick reaction of military and contractor personnel and the high degree of technical cooperation that followed. ★



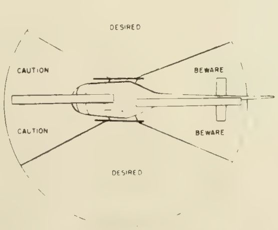
THE UH-1F HELICOPTER APPROACH AREAS

The UH-1F helicopter is fairly new in the Air Force inventory and chances are only a few people have had much association with it. The illustration here shows the approach areas; note particularly the potential hazards involved with this aircraft.

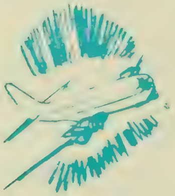
WARNING:

- **Do not approach when aircraft is starting up or shutting down. Main rotor can come as close as four feet to the ground in front of aircraft during this time.**
- **Do not approach tail when rotors are turning.**
- **Do not cross under tail boom.**
- **When loading baggage beware of jet exhaust.**
- **After loading or unloading baggage, make sure the baggage door is locked.**
- **Watch for signals from pilot at all times.**

821 Strat Aerospace Div (SAC), Ellsworth AFB, South Dakota



Aerobits



TAXIDENT — A C-97 was parked in front of and to the left of a transport. As the '97 started to taxi, the pilot was cleared to taxi straight ahead and then turn right to the taxiway. Instead, the pilot made a right-hand 180. As the aircraft came abeam of the transport, a transient maintenance man standing under the wing of the transport saw what was going to happen and signaled the pilot of the C-97. The pilot applied brakes but it was too late — the aircraft collided.

BRAKE SENSE — The accident related here was not caused by an Air Force aeroclubber, but it contains a lesson and similar accidents have damaged aero club aircraft. A Stinson, while taxiing, got bogged down in a mudhole at a civilian airport where an aero club keeps its airplanes. The pilot could not free the aircraft with power, so he set the throttle at fast idle, got out and pushed the airplane out of the mud hole. Free of the bog, the aircraft got away and collided with the tail section of an aero club Navion, causing extensive damage.

A similar accident occurred several months ago when an aero club pilot propped a Navion without first setting the brakes. The engine fired, the aircraft almost ran over the pilot, did run into a building. As of this writing the airplane still was out of service.

Never start an aircraft engine or permit one to be running without the brakes on. Better still, be sure a qualified person is at the controls and that the aircraft wheels are chocked.

KNOW YOUR LIMITATIONS — Eight hours after takeoff, the pilot called the local forecaster. Weather was reported as ceiling 100 feet obscured, three-fourths mile visibility and fog with runway visibility one mile.

Thirty minutes later, on final, the pilot was making the approach with the copilot monitoring instruments and watching for the runway to appear. Reported weather had deteriorated to ceiling indefinite 100 feet obscured, visibility one-half mile with light drizzle and fog, runway visibility three-fourths mile.

Upon breaking out the copilot took the controls while the pilot transitioned from instruments to visual flight. The aircraft was in a left drift, which the copilot attempted to stop with right aileron and rudder. The pilot assisted by pushing right rudder.

The right drop tank struck the runway. Landing was completed and when the aircraft had cleared the runway the gunner reported fuel leaking from the right drop tank.

The crew was lucky! This one ended up as an incident. It could have been much worse. We question the advisability of shifting control of the aircraft between pilot and copilot at this critical point in flight with a ceiling of 100 feet or less and visibility of less than a mile. Even more, we question the advisability of attempting an approach under such conditions. A much safer and wiser decision under such circumstances would be: *proceed to your alternate.*

Lt Col Harold E. Brandon
Directorate of Aerospace Safety

SAFETY PINS — A friend, Lt Col Frank G. Mitchell, former Chief of Safety at Edwards AFB, Calif., has called our attention to the fact that a number of transient aircraft have landed at Edwards without ejection seat safety pins aboard. Apparently the prime offenders are aircraft up for a local flight but which, because of an emergency, had to recover away from home base.

For the sake of crew safety, seat pins should be carried aboard the aircraft at all times. This also goes for external stores safety pins.

CURIOUS BYSTANDER — During a night training mission, a pilot was forced to eject from an aircraft because of engine failure. The aircraft landed on a farm.

Impact damage was not extensive and there was no fire damage so the aircraft was relatively intact. Due to the impact, the rear cockpit ejection seat was exposed and armed. Subsequently a curious bystander tampered with the seat trigger mechanism and actuated the rocket catapult, which caused the aircraft to be destroyed by fire. This precluded determination of the cause of the accident.

Fortunately, there were no injuries. If this had been an active combat aircraft rather than a trainer, the consequences could have been far more serious. Uninformed civilians might be expected to tamper with aircraft wreckage. Uninformed military personnel should not remain so.

Col Lawrence J. Pickett
Directorate of Aerospace Safety

INSTRUCTOR PILOT RESPONSIBILITIES — During the year 1964, instructor pilots were on board in three of the nine B-47 major aircraft accidents. Again, we are reminded that much has been said about the awkward position in which an IP is sometimes placed by a pilot to whom he is giving flight instruction. Specifically, when does the IP take control of the airplane?

This article is not intended to advise an IP specifically when to take over, but rather to warn him of the consequences of complacency or of allowing an erring student excessive latitude. Many of us like to think we have to fly like we drive our automobiles — defensively — constantly on the alert for someone or something trying to put us in jeopardy. And we try to stay ahead to allow for almost any contingency.

On the other hand, there are some pilots who are convinced that they can never be embarrassed by the idiosyncrasies of either man or machine. This attitude could easily be the first link in the chain of events that might lead to disaster.

It is difficult to believe that a highly experienced IP would allow his airplane to assume an abnormal nose-high attitude on takeoff and stall back into the ground. But this very thing happened — twice. Unfortunately, we are not able to ask the pilots "What happened?" because it was their final, fatal flight.

Many instructor pilots have traditionally believed that they were relatively immune from criticism while flying, and I do not intend to belabor the subject of complacency, but it does appear that this one item is again becoming a dominant factor in the accident picture.

Approximately four years ago a major command called in all its unit standardization pilots for some healthy discussions on aircraft accidents with instructor pilots aboard. During the previous year, IPs were on board the aircraft in most of the aircraft accidents, and some were extremely embarrassing. In one case an entire crew, IP included, bailed out of a large airplane when they assumed it to be out of control, but the airplane flew around for 59 minutes before it finally struck the ground.

In order to prevent aircraft accidents, every pilot, and especially the instructor pilot, must make an analytical evaluation of his personal proficiency, capabilities and limitations or he stands a chance of trading his wings for a wreath.

Lt Col David J. Schmidt
Directorate of Aerospace Safety

Aerobits

DAMP DRAG CHUTE PROBLEMS – Two F-84 pilots planned straight-in approaches and drag chute landings on a wet runway. In each case the approaches and landings were normal until drag chute deployment. In one, no chute was obtained. Later, on the ramp, the drag chute handle was recycled twice. The doors did not open, although the solenoid could be heard operating. The doors were then tapped and they opened. The drag chute was found to be saturated with water. In the other case the chute did deploy, at an estimated 120 knots. It blossomed, held momentarily, then collapsed as 11 lines broke. The chute was wet prior to deployment. Four of the broken lines were checked. They tested 300 to 1100 pounds over required tensil strength. Failure was believed due to excessive load imposed due to the moisture saturated drag chute. ☆

THE COLOMBIAN TROPHY

Awarded To The 612 Tactical Fighter Squadron, England AFB, La.

Lt Col Packard Larson, Commander, 612 TFS, receives Trophy from Mr. Marino Caiceda, Consul General, representing the Republic of Colombia.

The 612 Tactical Fighter Squadron, England Air Force Base, La., has been awarded the Colombian Trophy for 1964. This Trophy, a symbol of international friendship, is given annually by the Republic of Colombia to the USAF tactical unit having the most meritorious achievements in flying safety.

The 612 Tac Fighter Squadron compiled more than 17,500 hours in F-100 aircraft during the past three years while participating in full-scale deployments to Turkey, Clark AB, Philippines, and during combat support missions in Southeast Asia. During the latter, hazardous conditions included adverse weather during the monsoon season, mountainous terrain, limited facilities, and enemy ground fire. These conditions however, failed to deter the 612th in accomplishing its missions with safety, indicative of outstanding professionalism on the part of each crew member.

This achievement perpetuates the highest tradition and standards established for the Colombian Trophy and reflects great credit upon the 612 Tactical Fighter Squadron, the Tactical Air Command, and the United States Air Force. ★

☆ U.S. GOVERNMENT PRINTING OFFICE 1965 721-219/10

WELL DONE

CAPTAIN GARY K. CARROLL

71 FTR INTCP SQ, SELFRIDGE AFB, MICHIGAN

Captain Carroll was on takeoff roll in an F-106. He checked the airspeed, accelerating through 120 knots, engine instruments in the green. As he established his takeoff attitude, he heard a muffled bang and felt a jolt in the airframe. Rough vibrations followed. He checked his speed at about 140; better to continue takeoff than try an abort. He continued his takeoff, left the gear down and called Mobile. The mobile control officer thought the right main gear tire had blown. Another pilot on the taxiway confirmed Mobile's report. Cockpit indications were: all gear down and locked, hydraulic system safe. At that time Captain Carroll declared an emergency and flew by Mobile for a damage check. Mobile confirmed that the right tire had blown and most of the rubber was gone. Something was hanging; the right fairing door was pushed up against the wing. At that time Captain Carroll was concerned there might be some damage to the hydraulic lines. He talked with the safety officer on the ground and the director of operations and decided to make an approach end engagement. He asked for foam. The right side of the runway beyond the barrier was foamed as he expected pull to the right after hitting the barrier. He executed the approach end engagement as planned. The aircraft pulled slightly to the right into the foam and stopped with minor damage. WELL DONE! ★

USAF pilot responding most successfully to an inflight emergency
THE
KOREN KOLLIGIAN JR
TROPHY

THE

KOLLIGIAN TROPHY

IS PRESENTED TO

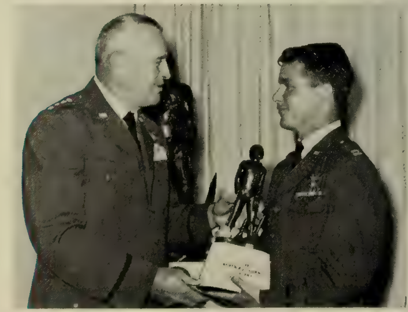
Capt James W Anderson

Captain James W. Anderson, 27th Tactical Fighter Wing, Cannon AFB, New Mexico, was awarded the Koren Kolligian, Jr. Trophy for 1964 for his outstanding performance during an overseas deployment. Vice Chief of Staff, General W. H. Blanchard made the presentation during ceremonies in the Pentagon on May 7. The award was based on the following incident:

During the third leg of the deployment, Captain Anderson, flying an F-100, lost TACAN and ADF radios and his UHF transmitter, and his element leader lost all radios. In addition, stronger-than-forecast winds caused the aircraft to have less than predicted fuel at destination. Typhoon weather prevailed with the field below GCA minimums in a driving rainstorm.

On final approach Captain Anderson realized that his leader's UHF was inoperative so he assumed the lead and initiated a go-around. With his SIF he established with GCA that another approach was desired. With minimum fuel remaining and with no radio contact with his wingman and unable to talk directly to GCA, Captain Anderson led the flight to another approach. Upon reaching GCA minimums, he was still unable to see the runway because of the heavy rain. With insufficient fuel remaining for another approach, Captain Anderson continued down the glide path picking up the runway lights at less than a half mile from the runway. The aircraft completed a successful formation landing.

Captain Anderson is the eighth recipient of the Kolligian Trophy, established by Mr. and Mrs. Koren Kolligian, Cambridge, Mass., in memory of their son who was lost on a flight in 1955. The trophy is presented annually to the Air Force pilot judged to have responded most successfully to an inflight emergency. ☆



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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

AUGUST 1965

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AEROSPACE SAFETY

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AFRP 62-1 AUGUST 1965 VOLUME 21 NUMBER 8

6th ANNUAL USAF SAFETY CONGRESS

Methods of preventing accidents throughout the Air Force will be the topic for consideration when the Sixth Annual Air Force Safety Congress convenes at Maxwell AFB, 10 August for a three-day meeting. Approximately 200 key Air Force command and safety personnel will attend the Congress and actively participate in working seminars. Attendees will delve into complex problems in the flight, missile, ground and nuclear safety areas in an effort to provide recommendations for resolving or reducing these problems. The agenda will include items from the Directorates of Aerospace and Nuclear Safety as well as safety subjects submitted by major commands.

ABOUT THE COVER

Pair of A1-Es attack Viet Cong barracks area along a canal. Mission capability is the ultimate objective of safety.

SAFETY TARGETS

"As accident rates get lower, accident prevention gets tougher." Obviously true. It is equally true that if we are to expect the present downward trend in accident rates to continue, we will all have to increase our efforts. The important question is, where do we best place our efforts in order to realize our safety goals?

The road of progress has invariably been constructed from new ideas, new approaches, new methods. I sincerely hope new and better accident prevention methods and procedures will be developed; and I strongly encourage the creative thinking of all of us to this end. However, while these new approaches are in the formative stages, let's take a good look at our known, tried and proven methods to insure they are being effectively employed.

We have a reporting system that includes UR's, OHR's, incident/accident reports, and 66-1 data, with hundreds of qualified and dedicated employees paid to analyze this information. However, what is the benefit of reports not submited or submitted incomplete? First, let's make sure we are submitting *all* of the pertinent information, *all* of the time. Second, let's have *all* echelons make a sincere effort at analyzing these data so that we may identify trends and detect soft spots.

There are a couple of other old "standbys"—Safety Surveys and Safety Councils. The good book tells us "Safety is a function of command." What better way can the commander place emphasis on safety than by insuring rigid, timely, periodic and unbiased safety surveys? How can he better display his personal interest than by organizing, and participating in, an effective periodically-convened Safety Council? Our surveys show that these programs tend to slip because of the pressures of other so-called "overriding requirements" or because of the belief that normal staff action will take care of the problem. Yet, the one big item most evident after we visit an organization is *the commander's safety interest and emphasis or the lack of it.* I strongly recommend that safety survey schedules be reviewed to insure they are properly scheduled and comprehensive and that the survey team is comprised of qualified personnel from all involved elements of the organization. Then ask yourself these questions concerning the Safety Council:

- Has it been regularly convened?
- Was the staff well represented?
- Were agenda items meaningful and pertinent?
- Was corrective action in order? Was it taken? Completed?

A Safety Council that lacks top level support and participation, or lacks solid, down-to-earth, pertinent agenda items can be a waste of time. Conversely, a properly directed program can bring to light some serious problems and can isolate and rectify some existing or developing accident potentials.

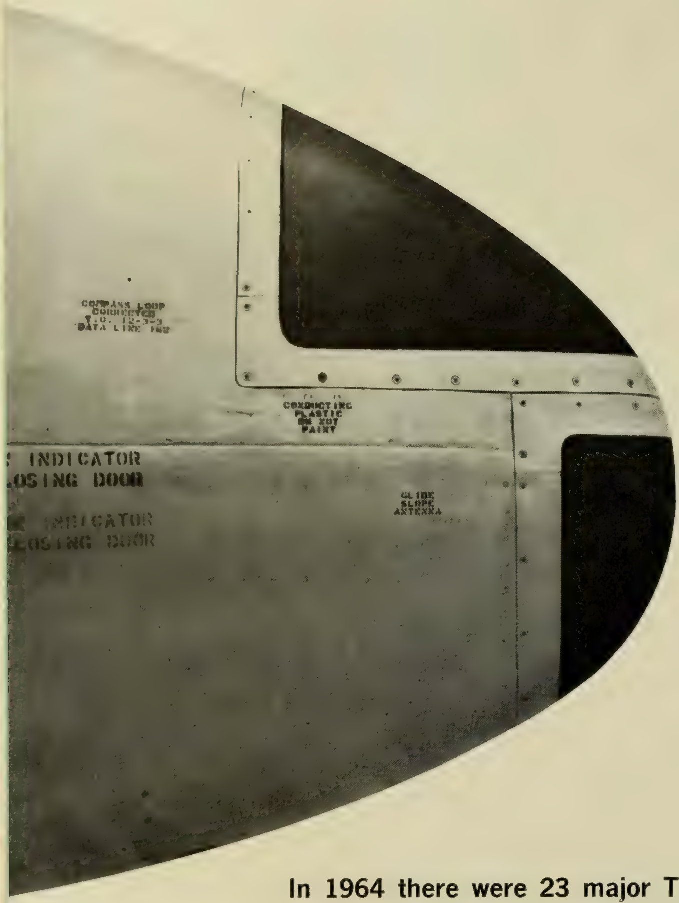
Another disconcerting item revealed by our surveys is the absence of a current Pre-accident Plan. This plan is an essential component of any dynamic accident prevention program. It should be tailored to the unit mission, capabilities, and facilities; then it should be periodically exercised, to insure prompt, effective response in the event of an accident. This plan should provide for the education and training of the accident board members as well as establish the *modus operandi.* In its true light, an accident is a failure of our accident prevention program. The pre-accident plan will not in itself prevent an accident, but it will set the stage for a better and more timely accident investigation. Good investigations give us a better insight as to the causes of accidents and the weaknesses of our preventive efforts, and indicate the need for improved design, or the requirement for better supervision and training.

This brings me to the last item on the list of accident prevention measures deserving special attention: *Safety training and supervision.* Just as pilots lose flying proficiency, individuals lose safety motivation and knowledge unless there is continuous re-emphasis and retraining. For a safety program to be dynamically effective, every supervisor must be aware of and analyze each function being performed by his people. He must ferret out the complex and possibly hazardous operations, then, insure that the necessary training, supervision and retraining is done so as to provide for the efficient and safe accomplishment of each function. To make safety training meaningful, and personnel responsive to the training presented, each commander will find it in his best interest to publicize his personal concern in safety. We know from experience that when the people get the word direct from the commander that safety is not a "tongue-in-cheek" exercise but a matter of vital concern to the Commander, the Air Force and the Country, they are understandably more responsive.

We cannot refute the fact that accidents are caused primarily by people. Of greater importance is the understanding that only people can prevent accidents. Therefore, it is axiomatic that an accident prevention program be dynamic and aggressive, and be of concern to and have the support of us all. ★

Jay T. Robbins

JAY T. ROBBINS, USAF
Major General
Director of Aerospace Safety



In 1964 there were 23 major T-33 accidents. How to prevent some mishaps in the future can be found in the . . .

TALES THE T-BIRD TELLS

Ubiquitous is the name for the T-33 but the old bird doesn't get around as much as it used to. The Gooney Bird of the jet set is gradually phasing out, but, although it's getting rather respectable in its old age, it had 23 major accidents last year.

The T-Bird is tried and, we have to admit, pretty true, but it just can't survive all the things people do to it – like the three times its crew flew it into the ground short of the runway. Or when the man in the rear disagreed with the man up front on takeoff. That one pranged on the runway after about two minutes of flight.

A glance at the cause factors can be revealing (Fig. 1). Percentagewise, pilot factor has remained roughly the same during the past three years and is down considerably from the 49 per cent in 1961. Maintenance factor, according to the figures, hasn't changed much in numbers but has advanced considerably percentagewise. Incidentally, two of the four accidents attributed to maintenance in 1964 occurred on the ground.

The big improvement is obviously in the Materiel column. Accidents caused by materiel factor have been reduced drastically, but this may indicate better maintenance and, possibly, better accident investigation. Curiously, the only two accidents in T-Bird history attributed to Other Crew Member occurred during 1964. We wonder too, so your guess is as good as ours.

Let's take a real brief look at those 23 major accidents last year; maybe there are some clues that will help prevent some future accidents.

The crew was making a night approach with 3000 ceiling, 2½ miles, light snow and haze. The aircraft hit a pair of unlighted radar antennae 600 feet short of the threshold, bounced a couple of times and touched down on the overrun. It finally stopped at the 3000 foot mark. The antennae were 78 inches high but extended only 1½ feet above runway level. PILOT FACTOR.

Shortly after the aircraft became airborne witnesses noticed a brief interruption in engine noise. Takeoff was continued and the aircraft was seen to make a climbing turn to about 600 feet, then enter a steep dive to the left and crash behind a cluster of trees. One pilot never got out and the other ejected too low. Cause. UNDETERMINED.

A student misunderstood the instructor and jettisoned the canopy in flight. The aircraft eventually crashed, although the IP ejected safely. Cause: OTHER CREW MEMBER.

During ground check of the engine by maintenance personnel, RPM increased rather than decreased during switch from normal to emergency fuel. After several attempts to adjust linkage, the fuel control was changed and another check made. Two start attempts with the automatic starting system failed to produce combustion. More trouble-shooting and an attempt at a manual start which resulted in an overheat condition and explosion in the aft section. MAINTENANCE FACTOR: engine technician did not turn off starting fuel switch when combustion occurred during manual start.

During left turn out of traffic, instructor and student noticed fumes and RPM decrease to 70 per cent and finally to 30 per cent with full throttle. Airspeed was maintained for landing and aircraft touched down 1260 feet short of the overrun. After shedding parts it stopped 20 feet short of the overrun and the crew evacuated safely. MATERIEL FAILURE, source unknown. The hose assembly between flow meter and starter fuel control had deteriorated internally and was the prime suspect.

During a night cross-country training flight, student returned to home base and said he would fly awhile to burn off fuel. Four minutes later he called and said he was in a spin. He never got out of the aircraft although he said he was going to. The aircraft crashed in a high speed dive. PILOT FACTOR (spatial disorientation).

The aircraft was taking off in a crosswind, visibility one-half mile, light and blowing snow, runway covered with puddles of water. At 115 knots the T-Bird got airborne but the attitude was not to the copilot's liking so he pushed forward on the stick. The man up front disagreed and tried to hold the attitude, whereupon the copilot retarded the throttle. The pilot reapplied power but the copilot had also extended the speed brakes and the aircraft came back down on the runway, sheared the pod, nose gear and left gear, took out some landing lights and finally stopped to the left of and 975 feet beyond the end of the runway. The crew got out safely. Cause: OTHER CREW MEMBER.

During a chandelle the nose got too high and during rollout the aircraft seemed to be about to stall. While attempting recovery the student pilot lost control and the bird went into a flat spin or tumble. When the aircraft passed through 10,500 without appearing to recover the pilot ejected. PILOT FACTOR.

During an SFO in an aircraft with chaff dispensers installed, configuration was throttle 50 per cent, 150 knots, gear and flaps up, speed brakes down. Speed brake switch in front was "down" and rear seat occupant was not advised to place his switch "up." Pilot made a tight turn to base and lowered flaps and gear. At this point the pilot decided he couldn't make it so he started a go-around. Throttle was advanced to full open and flaps retracted. A rapid sink rate developed and the T-Bird hit the ground in a full stall attitude 600 feet short of the overrun. PILOT FACTOR in that the pilot deviated from Dash One procedure.

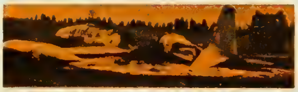
After level-off at FL 290, power was reduced to 93 per cent with all instrument indications normal. Soon smoke filled both cockpits and the fire warning light came on. Throttle was reduced to idle and the fire overheat warning test switch actuated. Both lights illuminated and the fire warning stayed on when the switch was released. The crew ejected. Cause: UNDETERMINED. Most probable cause was Maintenance Error — the "B" nut on the fuel vent line was not properly connected.

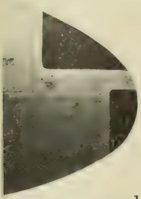
During takeoff the controls "felt mushy" so the student pilot aborted at 110 knots 2000 feet from the far end. Barrier engagement with

PRIMARY CAUSE FACTORS

	1961	1962	1963	1964
Pilot	38	14	8	8
Other Crew	0	0	0	2
Supervisory	8	2	3	0
Maintenance	1	2	1	4*
Materiel	18	13	10	4
Undetermined	8	7	2	4
Miscellaneous	5	1	0	1
Other Personnel	0	0	2	0
Total	78	39	26	23

*Includes two non-flight accidents





speed brakes lowered was unsuccessful and the aircraft finally stopped 339 feet beyond the end of the overrun. PILOT FACTOR: takeoff was unnecessarily aborted. The student was not aware of the extended takeoff roll that would result from braking to obtain directional control.

When power loss occurred just after the aircraft became airborne, the pilot aborted. Throttle was placed at idle and speed brakes lowered in an attempt to get back onto the runway in time to catch the barrier. Touchdown was about 50 feet in front of the barrier at 125 knots. The speed brakes deflected the barrier cable and the aircraft went off the end, losing the landing gear along the way. Cause: FOD which caused partial loss of power.

Touchdown was smooth but the left wing started dropping. The student pilot tried to correct by using aileron and brake but to no avail. The tip tank slid along the ground and the aircraft left the runway. PILOT FACTOR: gear was not locked down.

Shortly after takeoff RPM unwound to 30 per cent. Gangstart failed to produce a light and both pilots noticed fire reflecting on the tip tanks. The copilot ejected and the pilot stayed with the aircraft to clear a populated area. He then ejected safely. MATERIEL FAILURE, probably fuel system.

During landing with right brake inoperative, the aircraft touched down 200 feet past the threshold of a 12,000 foot runway. Flaps and speed brakes were retracted, throttle was stopcocked and the canopy opened. The MA-1A barrier was not engaged and the aircraft eventually ran into a chain link fence which overrode the aircraft and seriously injured the pilot. MAINTENANCE ERROR (improper inspection, failure to install proper length hose assembly).

The pilot informed the center that he was working between 15,000 and 20,000 feet in an acrobatic area. This was the last known contact with the pilot. About 30 minutes later the aircraft was seen to crash out of a steep, high speed dive. UNDETERMINED.

On initial solo flight student was attempting aileron rolls at 12,000 feet. The aircraft entered a spin and the pilot was unable to recover so he ejected successfully. Ejection was at about 60 feet above the ground while the nose was oscillating. Apparently the pilot got out at the highest pitch point. PILOT FACTOR: student was performing acrobatics with fuel in the tip tanks. The aircraft stalled and spun in.

Flight of two was making a penetration when wing man noted that he was falling back and RPM was decreasing. The engine could not be restarted and the pilot ejected at 7000 feet. MATERIEL FAILURE, probably due to electrical malfunction in the fuel shutoff valve electrical receptacle.

The pilot's write-up was "Emergency fuel jumped from 55 per cent to 65 per cent in emergency system." After checking, maintenance personnel replaced the emergency fuel control. During the ensuing ground check the engine appeared to operate normally until the crew chief decided to check the emergency fuel idle RPM. As he advanced the throttle through 70 per cent, the EGT went to 1000° and there was an explosion in the engine bay followed by fire. Cause: MAINTENANCE SUPERVISION. Prior to this occurrence, the engine had been changed and while the replacement engine was being installed the hose assembly (flow meter to starting fuel control) kinked. The mechanic assigned to eliminate the kink had trouble so he disconnected the clamps to relieve pressure on the hose assembly. A senior mechanic inspected the assembly and found it satisfactory with no kinks. Then during the ground check the lock nut which secures the elbow filtering for the flow meter loosened and a severe fuel leak resulted in fire.

The landing was proceeding normally until touchdown when the right tire blew out. The aircraft left the runway and hit a drainage ditch where the nose and right main gear folded and the left main sheared. MAINTENANCE FACTOR: the navigation publication holder was not properly secured, came off and lodged under the left rudder pedal preventing pilot use of the left pedal and brake.

The engine flamed out on downwind and the pilots ejected. MATERIEL FAILURE of undetermined cause but probably because of a malfunction of the electrical circuit connecting the emergency fuel control solenoid to the engine wiring harness.

During a low level solo target mission the T-33 target aircraft crashed in weather described as variable snow showers and changing visibility. Cause: UNDETERMINED, however it was thought that the pilot was either disoriented or attempted to fly VFR in IFR conditions.

During a GCA-monitored ILS final the IP took over about two miles out. The aircraft hit short and bounced up onto the overrun. Both pilots received back injuries. PILOT FACTOR: the aircraft was allowed to stall on final and the IP did not use pitot heat with visible rime ice on the wings. Contributing was the IP's marginal proficiency in the aircraft.

For the past three years the T-Bird accident rate has remained substantially the same, 3.9 in 1962 and 3.2 during '63 and '64. This is not the irreducible minimum, as indicated by the findings in the 23 accidents related above. A little more care, more attention to detail would have prevented several of these mishaps.

During the first quarter of this year there were four major accidents. T-33 pilots and maintenance personnel have the answer to the question of how many more there will be during the balance of the year. ★

THE PRESSURE FACTOR

By a Student Attending the FSO Course at USC

The pressure factor of an organization is directly proportional to the unit's standing during the last three weeks of the quarter, inversely proportional to the pilot's experience level and directly proportional to the push of the commander, operations officer, or maintenance officer, who in turn is attempting to prevent another late takeoff, abort, etc. There are many other variables that can be added to this equation, but I'll let you decide which these are when you objectively compute the pressure factor of your unit.

I was a member of an organization that had a high pressure factor. One clear, warm, Wednesday morning, the third week of the quarter, I was scheduled for a refueling mission which I had performed many times before.

The aircraft preflight went like clockwork; in fact not a single discrepancy was noted. The engine runup was completed and everything was as it should be. Three minutes prior to scheduled takeoff I taxied to the active, completed the checklist, and started my roll. The takeoff proceeded as it always had until the flight engineer reported that torque on Nr 4 was 5 pounds below reject and the copilot called line speed 5 knots below predicted. The takeoff was aborted. After clearing the active the engineer rechecked the engine. The engine checked perfectly. The Command Post was informed of the problem. The controller (an old head) came back with a solution by advising me that he had flown aircraft in World War II (or was it World War I?) and they never had torque meters, but were still able to hack the mission without them. (Another small problem — our aircraft was scheduled to refuel the Wing Commander.)

I advised the controller that we would try again and taxied to the end of the runway. Prior to taking the active, we again checked the Nr 4 engine. Still no problem. Everything checked perfectly. On the second attempt Nr 4 torque was 10 pounds below reject, and line speed was 15 knots below computed. We aborted. As we cleared the active we shut down Nr 4. The engineer pulled the mixture control to idle cutoff and the propeller stopped abruptly. I notified the Command Post and taxied back to the hard stand. As I taxied in my reception committee had already assembled.

I completed the checklists and deplaned to greet the squadron operations officer and the chief of maintenance. As requested, I again covered the reasons for aborting the mission. The only response to my statement was from the operations officer who said, "There damn well better be something wrong with the engine." When maintenance personnel attempted to move the propeller it wouldn't budge. The engine had frozen.

As I walked back to the squadron with my crew I thought to myself — what would have happened had I continued the takeoff and the Nr 4 engine had frozen just at lift off? At maximum gross weight, that old bird just won't climb on three engines when the weather is beautiful and warm. Gee, but the pressure factor of this outfit is high!!

Let's examine the equation once again. Our unit was way down on the totem pole. This factor was enough at times to push the pressure factor way up. I had a fair amount of experience in the aircraft so this offset the other factors to some degree. Our operations officer was a real pusher, you know the type. This really increased the pressure factor.

What can you do to keep the pressure factor at a low level? You can increase your proficiency and knowledge of the aircraft to such a degree that the push factor has little effect. And you can assist maintenance by making entries in the Form 781 clear and concise. A well maintained aircraft really helps.

Now, think it over — what is the pressure factor in your unit? Let your Dash One be your guide. ★

MATERIEL FAILURE

By Col John A. Brooks, III
Tactical Air Warfare Center
Eglin Air Force Base, Fla

This story is not about pilot error, supervisory error, or materiel failure of the aircraft. This is one about materiel failure of the pilot while on a routine proficiency flight.

The cross-country west with Captain Stan Pyne was uneventful. Where? Nellis natcherly. The F-100F worked perfectly and everything turned out just right.

We had the usual visit with friends at Nellis, the usual round of lounge shows in town. Even the usual amount of sleep — well almost — but adequate.

We agreed to arise (Sunday) about 1000 local, however the next morning Captain Pyne got up a little early and had the flight plan and clearance completed before I arrived on the scene. Remembering what experience and the good flight surgeon says, I ate a regular breakfast, but must confess I more or less bolted it, in an effort to catch up with Stan.

On the way out to the aircraft, and again once or twice while waiting for the starter unit, I noticed a fairly sharp pain in my stomach. All this I dismissed from mind rather readily, blaming myself for eating breakfast too fast.

By the time we were strapped in and ready to go, the pain was gone and I thought no more of it — that is until the climbout. An afterburner climb to 18,000 feet was in order because of the short departure leg to Cannon AFB, and here's where trouble reared its head again. The short sharp pains I had blamed on breakfast now returned with a vengeance and lasted throughout the climb, so much so that I overshot the planned cruising altitude by 1000–1500 feet. After

level off the pain varied in intensi- fast — electrocardiograms, blood tests, x-rays — you name it and they ty, but never stopped completely. I warned Stan of the situation and we planned to let down to 10,000 feet over Albuquerque and then gradually at Cannon. It was VFR all the way. At the lower elevations the pain lessened and during the landing at Cannon it was hardly noticeable. In fact, one of the best ’100 landings I have ever made.

The wing commander of the 474th Tactical Fighter Wing at Cannon, met me on the line and we exchanged the usual kidding about being too old to fly, etc. At this point, I wasn't too sure. I notified Stan to plan to take the front seat for the last leg from Cannon to Eglin.

By the time we were turned around and ready to depart, I wasn't much better, so I went to see the Flight Surgeon on duty at the hospital for a checkup.

The doctor confirmed my diagnosis, gas pains, and gave me some medicine for relief. He preferred that I remain overnight, but advised that I should at least stay on the ground until the pain completely subsided.

I agreed and obtained a suite in the VOQ where Stan could watch TV or visit friends until I felt able to continue the flight. I had no doubts we would be able to take off in two or three hours. I even dropped off to sleep for a short while. But, when I awoke I realized something was really wrong and asked Stan to notify the hospital.

The reaction was immediate. The hospital commander and senior flight surgeon came over, checked me briefly, and away I went for my first ride in the meat wagon. The reaction in the hospital was equally did it. They even called in a consultant surgeon from town. By 10 o'clock that night the cause was still a mystery.

The tests continued the next morning, Monday, but still didn't provide any positive answers.

About 1400 hours, the hospital commander came in to see me. The look on his face told me a decision had been reached. He said the tests had ruled out many possible causes, but had not revealed the true cause, and that exploratory surgery would be necessary.

This would come as something of a surprise, if not a shock, at home. The family realized I was just out flying to keep my hand in, but to end up a thousand miles away, facing a knife, I'll have to admit my mind searched for ways of trying to get home. Yet the facts were inescapable, it would have to be done and the sooner the better. About 45 minutes later (1450 hours), I rolled onto the operating table.

I remember being awakened later that night. I got up and walked a little, with considerable urging and help I might add. But it was the next day before I really learned what had happened.

It turned out I had a hole in the mesentery tissue of my back. (This tissue supports the intestines, kidneys, etc.) It is possible for the small intestine to work itself into such a hole. The doctors tell me this could have happened dozens of times without discomfort. However, it happened once again at the time of climbout. The gas in the small intestine expanded and eight inches became strangulated in the hole. Although the pain subsided on let down, the irritation or injury was such that the condition persisted and the operation became necessary.

As I relive the experience, I strive to figure out what could have been done differently. True, I shouldn't have bolted breakfast, but to me the pains before takeoff were not nearly severe enough to abort the flight. They were the mildest kind of warning, but a warning nevertheless. After level off they were not severe enough to impair flying in any way. On let down and landing they subsided, but I still saw a flight surgeon — a sensible decision.

I asked the doctors what would have happened if I had continued the flight to Eglin, even in the back seat. They were unanimous in their opinion that I would have aborted the flight almost immediately and could have suffered further physical damage. As I look at that six inch scar I wonder how much further!

It was a weird experience to say the least. I pass this story on not because it is likely to happen to you but to illustrate what could happen. Now, back on flying status, my thoughts return with many thanks to the correct decisions that were made; (another hour or two delay and I would have lost 18 inches of my intestine), and to the excellent care I received.

Almost forgotten are the eight days of intravenous feeding, the ten days with a tube in my stomach, the endless tests, etc.

Not forgotten is the fact that I was extremely lucky. And besides, I got a free appendectomy — and the best executive physical exam one can get. Too bad it wasn't closer to my birthday. ★

THE BENDS

By 1/Lt Jerry B. Smiley, FSO, Webb AFB, Texas

SCRAMBLE!

I ran to my bird, hurriedly climbed the ladder and jumped into the cockpit. The crew chief started the aircraft as I checked in with Blue Lead.

Start, taxi and takeoff were normal; however, during the climb I noticed that the cockpit pressurization system was inoperative. I knew I should not continue, but I would not abort if there were a combat mission. I pressed on!

Flight lead contacted the ground controller. We were not committed against a target; our mission was combat air patrol at 35,000. I thought, "This altitude will be no problem without pressurization." I was correct. After one hour of combat air patrol, we returned to the base. I had encountered no difficulty.

During an exercise such as this we were allowed only 15 minutes after landing to return an aircraft to five minute alert status. I told the crew chief of the pressurization problem and instructed him to correct it if he could, but the aircraft would have to be placed on five minute alert within the allowed 15-minute time period.

I returned to Ops for debriefing and rebriefing. Suddenly the scramble signal appeared for four flights. I was number two in the fourth flight. As I hurried up the ladder, the crew chief reported that the pressurization system was still inoperative. Again, I pressed on!

This time we made an afterburner climb to 45,000. When we leveled off at assigned altitude, I experienced difficulty breathing against the oxygen pressure in my mask. I had almost decided to return to the base when the flight leader's radar became inoperative. With this change in the situation, I felt that I must intercept that target.

I assumed lead of the formation and began the intercept. Suddenly I had pain in my arms and shoulders. The bends! But I was too close to quit. I completed the intercept at 51,000 feet.

I initiated a rapid descent to penetration altitude when Blue One instructed me to maintain present altitude. He had lost AC power and wanted to join on my wing for the weather penetration. I leveled off at 40,000, but the pain was severe by this time.

My arms were almost useless. When I attempted to apply stick and throttle corrections the pain was almost unbearable. I advised that I could not maintain present altitude and initiated a maximum rate descent to 20,000 feet. When I leveled off the pain was gone.

I landed without further difficulty. I noticed an ambulance as I taxied into the parking area. The flight surgeon came running up to the aircraft. He scrambled up the ladder to the cockpit. I told him that everything was all right; however, I had had a few uncomfortable moments at high altitude. He was very understanding. I was confined to the hospital only one night and to mobile control for only two weeks.

Ed. Note: A flight surgeon, through whom this article was coordinated, asked that this note be added: "This intrepid birdman was extremely lucky. Hypoxia and/or bends could easily have resulted in another CAUSE UNDETERMINED accident!" ★

ONE INCH TO SURVIVAL

The mission had been routine, now, 30 minutes out, we were giving our offload information to the Airlift Command Post controller. He copied our message and adv[illegible]ised us of the weather. The altimeter set[illegible]ting he gave us was a low-low readin[illegible]g of 29.68. The co pilot copied the [illegible] altimeter setting, and questioned me [illegible] on the meaning of the prefix "low-low." I had never heard it before, but since the altimeter setting was lower than usual, we assumed it to be a matter of little concern and decided to ask about it on the ground. It was high time to get a descent clearance.

By Capt Fred G. Knieriem, 133 Air Transport Wing (NJ ANG), Newark Airport, Newark, N. J.

We were anxious to get down and I fear we listened to the descent clearance from Center, and to little else. An altimeter setting of "low-low" 28.68 never rang a bell. I was calling for lower power settings from the engineer to get the Connie down faster, and also telling the copilot to start the descent checklist. I thought he was doing a great job, reading off the items on the checklist and replying to approach control at the same time. As we passed through our transition altitude, we calmly set in our altimeters the 29.68 reading he had copied.

I asked my copilot to request a VOR approach, and proceeded outbound at approximately 4000 feet, still descending and starting to slow down. Minimum procedure turn altitude was 1500 feet. We were well out over the water when I began my procedure turn at 2000 indicated. As I watched my localizer needle begin to move toward the center, I began to level the wings. Then my heart skipped a beat as the flight examiner standing behind me screamed that we were too low and would hit the water. Almost instantaneously I pressed forward on the throttles, yelled for "max" power, and looked out in front of the aircraft while pulling back on the yoke. Although the altimeter read 1400 feet, the water below us seemed practically in the cockpit.

Then approach control called. They said they had lost us on their radar screen, asked if we were in any difficulty and requested us to check our altimeter setting of 28.68. Then we knew. At 29.68 we had misset our altimeters by one inch. This put us ONE THOUSAND feet below the altitude we were indicating. Had the weather been bad or had we been making this same approach at night, someone else probably would be writing this episode as part of an accident report. Luck was with us. I am able to make this report in hopes that some other airman may benefit.

We later learned that a weather man had written a sloppy eight and it looked very much like a nine. An honest error (if there is one) but almost very costly. Even though this error was made at both ends of the field (weather and Airlift Command Post) and no doubt would have been considered as a contributory factor had there been an accident, *we* carried the ball the entire length of the field.

To begin with, the weather advisory given to us by the ACP should have been considered as an advisory and nothing more. The weather given to us by approach control is the information we must use in making an approach or planning to proceed somewhere else should the field be declared below minimums. The new expression "low-low" should have been questioned by us at the time, and not later on the ground. Of course a big cause factor was our desire to hurry. We had spent six hours getting to our destination, yet we had to try and save a minute or two at the end.

I know I learned a lesson and so did the crewmembers with me. It is not often that so small a measurement as ONE INCH may mean survival. ★

TRAINING DRIVERS TO
Live

By Bob Harrison

Did you know that if you have been in the Air Force for 13 to 18 months that your chances of having had an injury-producing automobile accident were 26 per cent?

Or that, if you've been around for three years, the probability dropped to six per cent?

So you've been in for 10 years and have yet to have your first auto accident. Well, read on, because chances are you supervise some younger airman or officer and what happens to him is your concern.

Air Force concern from the top right on down to your squadron has been growing to the point where a million dollar program is about to go into effect in an effort to save lives and money through the prevention of traffic accidents involving USAF personnel. This program is probably the most ambitious yet undertaken by any agency in terms of cost and numbers of people involved. And the USAF expects to make a profit out of this endeavor. You as an individual stand to gain too, hence the following to give you an idea of where you fit into the picture.

ACCIDENTS COSTLY

It is easy to see why the Air Force has plunged into a program of this magnitude. From 1954 through 1964 this service has lost nearly 5700 people as a result of motor vehicle accidents at the staggering cost of $229 million dollars (Figs. 1 and 2).

Over the years, various training programs and disciplinary actions have been tried with questionable results. Finally an Air Force-wide program aimed at getting the young officer and airman as early as possible in his military career is about to begin. The goal is to reduce the number of accidents by improving individual driving habits. The primary target is the young man under 26, but the program will track him until the day he retires. The sequence of events will be essentially as follows:

At the induction center the new airman will fill out a questionnaire as to his pre-service driving experience and training. (Officers will complete the form at their first base of assignment.) The questionnaire will record his vehicle ownership, traffic violations, accident record, operator license and training. This form will become part of his personnel records until he arrives at his first duty station.

There he will be tested on his attitude toward driving and his accident susceptibility factor, prior to completing a 20-hour junior college level driver training course. Two hours of this course will consist of local indoctrination, the balance will be on traffic safety.

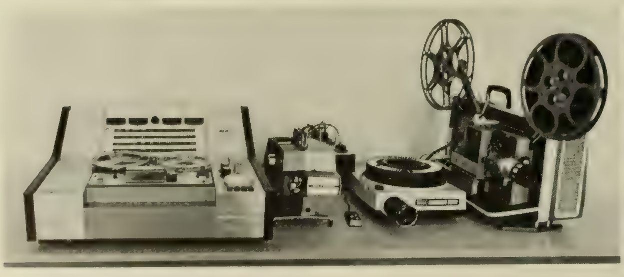
FOLLOW-ON TRAINING

After completion of the standard course each individual will go through a four hour refresher course two years later. From then on he will receive a two-hour local indoctrination at his new base after every PCS. Meanwhile, however, when an individual builds up six points, based on accidents and moving traffic violations, he will be subject to a 10-hour driver improvement course designed to correct the specific habits that got him into trouble.

The program at each base will be conducted by the safety office, which will maintain records on each individual, provide instruction and collect data for evaluation of the program. Instructors are presently being trained by the contractor, Edex Corporation, Mt View, California, who provides both the program content and equipment. They will then be assigned to the safety office at air bases where they will conduct training and maintain the equipment.

The 20-hour course is based on the premise that young men coming into the Air Force know the mechanics of an automobile, probably have had previous driving experience and some training. How-

Audio-visual equipment for use of slides, movies, film strips, tape.



Student responder.

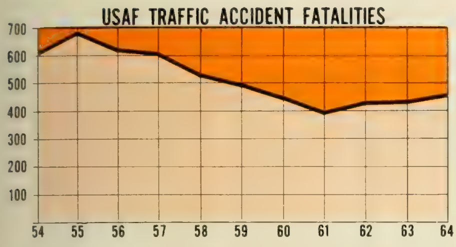


Figure 1

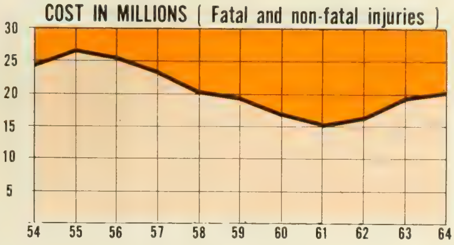


Figure 2

ever, it is recognized that they need to be fully indoctrinated in their obligations behind the wheel as members, and consequently representatives, of the Air Force. Therefore, the aim is to acquaint the young driver with the many hazards of the hostile environment in which he drives an automobile. The limitations of the human being and the vehicle he drives, the roads, weather, are all factors with which he must contend in the safe operation of an automobile and which are covered in the course.

LATEST EQUIPMENT

Audio-visual equipment will present traffic problems. Students observe the problem on a screen, then answer questions by pushing buttons on individual consoles. The answers are recorded instantly, thus giving the instructor an indication of individual and group understanding.

Since 55 per cent of automobile accidents occur within a 15 mile radius of the base and 70 per cent within 25 miles, the two-hour local orientation course to be presented to personnel on arrival at a new base will stress local laws and customs and hazards in the vicinity of the base.

Periodically a summary will be prepared of information gathered from the bases where training is being conducted, major commands, bases designed for quality evaluation, and from the 6570 Personnel Research Laboratory at Lackland AFB. Revision of the program will be based on analysis of this information.

The scope of this program is evident from the projected training requirements through FY 67. It is anticipated that about 145,000 will complete the basic course during FY 66, which includes a backlog who entered the service during FY 65, and 105,000 in FY 67.

Although the cost in time and money for a program of this size is considerable, a conservative estimate of savings during the first two years is 150 lives and $7.5 million. In addition, a number of bonus results are expected, such as training of government vehicle operators, an improved Air Force image and possibly use of the training equipment for other programs.

For the Air Force this program will pay big dividends. But the biggest winner will be those who otherwise would have been merely statistics in the lives-lost column. ★

TAPE DRAGONS

New members of the Grand Order of the Tape Dragons at the 539 FIS, McGuire AFB, N. J., are, front row (left to right): Captains Billy R. Givens, John C. Barnes, H. K. Spiker and Leslie C. Conwell. Back row (left to right): Captains John K. Featherstone, Thomas W. Beaghen, David Steinke, and Joseph P. Ries. Absent when photo was taken were Captains Manford C. Holly, Hermon A. Dungan, John O. Hastings, Donald C. Windrath and Owen J. Giblin. Membership criterion is a successful emergency engagement of an aircraft arresting barrier. Certificates state the award is for "heads up excellence in the art of snaggin' and draggin' the nylon tape of land-based aircraft arresting equipment, and turning an emergency situation into a happy landing."

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. Please explain how a VOT (VHF Omni Test) operates and the proper method of checking a VOR receiver with a VOT. What is the acceptable tolerance if I use a VOT in flight? *(Capt Perry A. Hudel, Andrews AFB)*

A. To put it simply, a VOT always transmits an in-phase signal. Regardless of your position relative to the VOT, your receiver always reacts as if you were located on the 360 degree radial. If you select 000 in the course selector window, the TO-FROM indicator should show FROM, the CDI should center and the bearing pointer should point to 180 degrees. If you select 180 in the course selector window the TO-FROM indicator should show TO, the CDI should center and the bearing pointer should again point to 180 degrees. (To refresh your memory on what we mean by the term in-phase signal, check AFM 51-37, ch. 10, pp 10-1, 10-2.)

The acceptable tolerance when using a VOT is ± 4 degrees. This tolerance applies whether you are in flight or on the ground.

For the pilot who has never used a VOT, these facilities are low powered VOR stations located on most of the large civilian airports. They provide an excellent means of checking the accuracy of your VOR receiver since you don't have to taxi to a ground check point or make a guess as to the correct bearing from your position to the station. VOT frequencies are listed with airport information in the Facility/Directory portion of the FAA Airman's Information Manual (AIM). If this publication is not available, check with the tower, Base Ops, ATC or the Flight Service Station and they can tell you the frequency.

POINT TO PONDER

We would like to direct this month's Point To Ponder toward something that has a direct effect on every pilot in the Air Force — instrument panel design.

Here at IPIS we have done extensive work with instrument arrangement and we have some opinions we would like to share with you.

First, let's face the fact that in attitude instrument flying, it is the Attitude Indicator that should be the focal point of the cross-check. Therefore, the ideal arrangement is to have this instrument in the center of the panel. Next, let's consider the information the pilot needs when a change in pitch is made either intentionally or inadvertantly. Vertical velocity and airspeed seem to fit the bill here. Of course, altitude is very important too, but since the Vertical Velocity Indicator will give the first indication as far as a gain or loss of altitude is concerned, we can use this instrument very effectively. Having settled on these parameters it would seem logical to place the Vertical Velocity Indicator and the Airspeed Indicator on either side of the Attitude Indicator. As far as pitch control is concerned, this arrangement requires a minimum of eye movement. What do we do about bank control? Place the Heading Indicator directly underneath the Attitude Indicator. Here again, eye movement is held to a minimum and vital information is presented in a logical arrangement. Now if the Altimeter is placed underneath the Vertical Velocity Indicator and the Course Indicator put on the other side of the Heading Indicator, the instrument panel arrangement is all but complete. Of course, we realize that different aircraft have different instruments available and this will require some other type of arrangement, but the basic idea can still be applied. The relative position of instruments within the pure basic six concept is not too important — it is only when the instrumentation has been changed to the extent that basic six is no longer recognizable that performance is significantly jeopardized.

We have a T-29 and a T-39 here at IPIS with this arrangement installed, and it works. Makes the cross-check much easier and precision is much more easily achieved.

Unfortunately, there are some panel arrangements in use today that almost defy a pilot to achieve a high degree of proficiency when he is "on the gages." We wish we could say that these poor arrangements are the exception rather than the rule, but, unfortunately, they are not. When you stop to consider how many instruments are obscured by control columns or are located in such a way as to create real problems with parallax, this situation takes on added significance. The mission of a particular aircraft will dictate panel arrangement to some extent, but it would appear that in most cases no real thought has been given to the problem. ★

Let's COLDCOCK Ol' Murph!

By Lt Col Frederick C. Blesse, Directorate of Aerospace Safety

For many years now, we in the Air Force have been quoting "Murphy's Law" (If an aircraft part can be installed incorrectly, someone will install it that way) and chuckling about how some unthinking maintenance technician installed some simple little part backwards. Maybe at one time it was funny because aircraft were relatively simple and the result was not usually catastrophic. A Murphy these days is no brush with Blackie Carbon. It's a serious design error that must be coped with by operational and maintenance personnel on a daily basis.

If you'll stop to consider how long we have been talking about Murphys, you will begin to have an appreciation for the seriousness of the problem. This problem is growing with the complexity of our aircraft and so is the seriousness of each Murphy we uncover.

Let's take our newest aircraft, the F-4C. Certainly, all the latest design features have been incorporated and there should be as few here as anywhere. What would you guess? Five? Twenty? Thirty? If you were only right, our problem would be easier than the one we have. At this point there really is no way to determine how many F-4C Murphys we do have but constant scanning of Navy and Air Force data has revealed the absolute presence of 105.

The collection of these was effortless in a way. No real drive was initiated; they just kept cropping up with such regularity that someone decided to record them. A complete list of these may be obtained, if desired, from the Directorate of Aerospace Safety, Flight Safety Division, AFIAS-F2, Norton AFB, California.

If you have Murphys that aren't included in the booklet you receive, fire them off to Norton and they will be added to the list and circulated. Only in this way can we help to lick Ol' Murph.

We want to do more than just eliminate him from the F-4C, however. To do otherwise would be like brushing the ants from the top of their mound as a solution to the problem of too many ants. Sitting on that solution would be a lot more pleasant than sitting on the Murphy solution as we have been doing for the past 10 years.

Here are some examples in the F-4C of how serious these Murphys can be. The integrated power control cylinder can be wired in reverse. The result will be a violent aircraft yaw/roll oscillation. Electrical connections can be cross-connected to the stabilizer augmentor servo control valve. This mistake will cause violent rolling tendencies in flight at 230 knots. Pitot static lines can be cross-connected causing erroneous readings. A number four cell fuel transfer pump can be installed in the number six fuel cell. Use of the short pump will leave about 300 pounds of fuel unused in the number six cell. The canopy pneumatic flow restrictor valve PN 8A7644-39 can be installed in reverse. This will allow the canopy to slam closed when actuated. I could go on and on. Each one a potential death trap — maybe for the pilot, maybe for the maintenance man who next works on the system. All unnecessary.

We absolutely must design Murphys out of our aircraft systems — even then there will be some that creep in. To cope with our present situation, industry as well as the Air Force must design operating procedures to eliminate Murphys when discovered. A central office, possibly, with all known Murphys on the aircraft could advise when modifications are requested on any area of the aircraft. From the looks of our TCTO backlogs, every part in the aircraft is modified at least five times. During one of these mods, design the "Murphy" out. Operational personnel should be constantly on the lookout for such things. Maintenance personnel in tactical units should be ever watchful and AFR 127-4 should be revised to require the reporting of a discovered Murphy regardless of the weapons system involved. Depot personnel, too, are in an ideal position to uncover the insidious fruits of poor design.

We have lost almost two billion dollars worth of aircraft since 1955 —that's a million dollars a day, and don't kid yourself — Murph is getting his share.

Let's coldcock Ol' Murph. ★

BRAKING...A HE

By S/L G. C. Letcher, RCAF
(Reprinted from Flight Comment, Mar-Apr 1965)

Recently a CF-104 pilot aborting a takeoff decided that there was sufficient runway remaining to stop without deploying the dragchute. He probably reasoned: there's 9000 feet of dry runway ahead of me and the AOIs indicate that I can stop in half that distance. Why bother with the dragchute and put the groundcrew to all the extra work of picking it up, repacking it and installing another in the aircraft? The photos here give the grim answer.

Did this pilot consider all the factors in making such a decision? Obviously not—the aircraft suffered "D" category damage.

The pilot had no difficulty stopping, or for that matter, starting back to the ramp, but obviously there is more to braking than this pilot knew at the time. So loosen that grip on the latest Playboy and give a close look to some other figures. Although not as pleasant to contemplate, they may prove hotter than you think. Before deciding why our jockey found it necessary to dismount the noble steed with embarrassing haste while getting it back to the barn, a few facts might be recognized to make the discussion understandable.

First, let's agree that energy cannot be destroyed; it is only convertible to some other form. Thus, in stopping an aircraft the kinetic energy of aircraft motion plus the energy from the idle thrust of the engine, is converted to heat energy by the wheel brakes. To simplify calculations we will ignore the low aerodynamic drag of the CF-104, the heat created by rolling friction and tire flexing (which can be considerable), and the runway profile (in this case, practically level). So much for the theory, now the facts:

CF-104	170 kts
Aircraft weight	21,000 lbs
Runway remaining	9000 ft
Engine thrust (idle)	400 lbs

Now, using the formulas: $KE = \frac{1}{2}MV^2$ and $W = FXD$ to find the aircraft's energy plus the energy due to engine idle thrust, we compute the total kinetic energy the brakes converted to heat energy as 30,800,000 ft lbs. Dividing this figure by 778 converts the foot pounds into heat energy units – British Thermal Units –or 39,500 BTUs.

What does this mean to the fellow who doesn't carry a slide rule as a status symbol? In the colorful prose of Don Stuck, experimental test pilot for McDonnell Aircraft, it's equivalent to the energy required to lift a five-ton elephant more than 3000 ft in the air, or enough heat to melt 146 lbs of steel!

To equate these images with something more practical, let's compare it to the BTU limitations of the brakes. The brake designer's biggest headache is the effect of heat on components; the components weaken with heat – something is going to give if things get too hot. The Bendix brake used on the 104 has a normal use capability of 50 stops at 7700 BTU and an emergency one-stop capability of 12,800 BTU. During the stop we described, the brakes generated one and a half times more heat than they are built to withstand during an emergency stop. It is important to realize, also, that the heat generated by brakes is dissipated largely by air flowing past the wheels, brakes, and tires, while the aircraft is moving.

At this point you may be inclined to say, "So, the pilot goofed – it won't happen to me." But before returning to the petite heat of Playboy let's have a look at another recent incident.

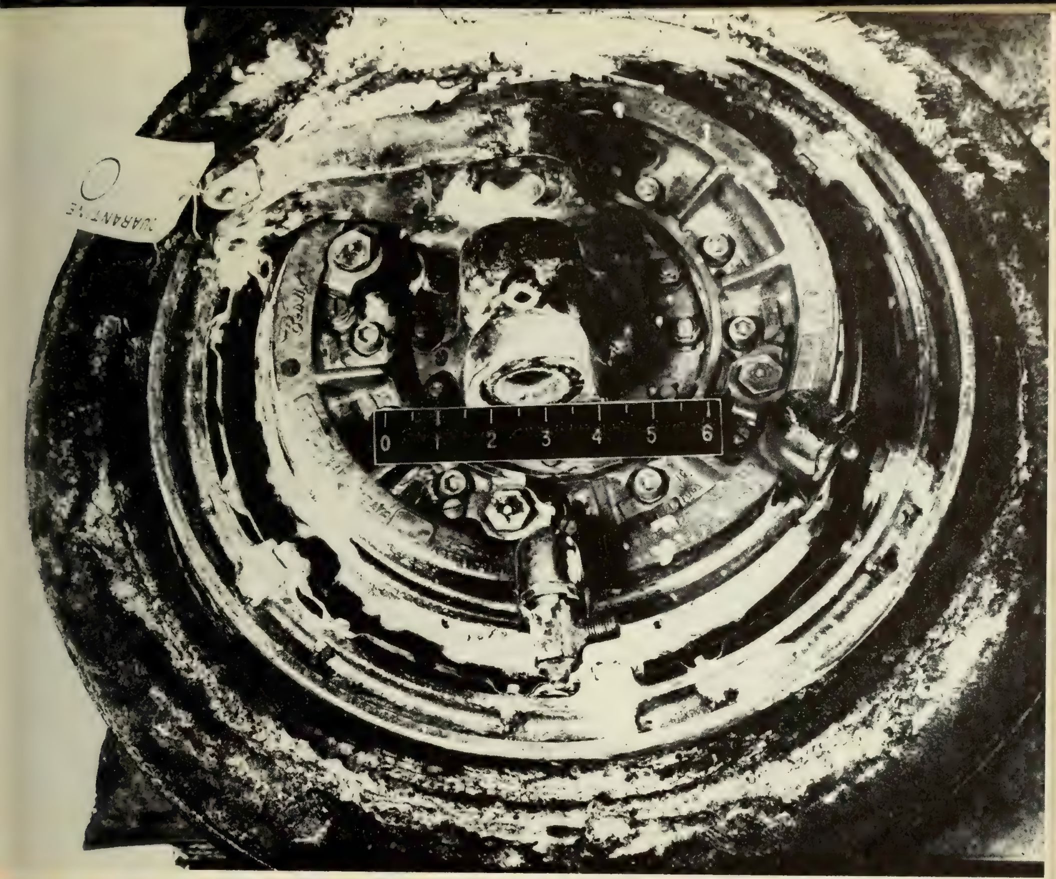
A CF-101 crew were detailed to take part in a National Research Council noise level study. The exercise required them to line up at the end of the 10,000 ft runway, cut in the afterburners and immediately abort the takeoff roll. Four of these runs were made; each time the pilot employed maximum aerodynamic braking – quite effective on the 101. The aircraft rolled the full length of the runway on each run, then returned to the starting point. The brakes were used only on the first run and then very sparingly. On subsequent runs no brakes were used and only nose wheel steering was used for turning. As the aircraft cleared the runway at the end of the fourth run the brakes seized and were so hot they welded the wheels to the forks of the undercarriage!

Sure enough, the AOIs place a restriction on how far the aircraft can be moved without allowing a cooling period because of insufficient dissipation of the heat created by disc brakes, rolling friction and tire flexing. The restriction is there but it doesn't exactly jump out off the page at you. (In the meantime you may rest assured that a closer look will be taken at the information given in the CF-104 and 101 AOIs.)

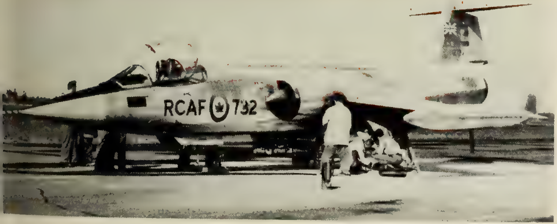
For those who are still skeptical that the problem of heat in the wheels of high-performance aircraft is worthy of consideration here is an even more startling case.

A civilian airliner's takeoff was delayed due to fog. The captain decided to lend Nature an assist by using the jet exhaust to heat things up a bit. A takeoff roll was commenced and aborted; the aircraft was returned to the takeoff position, by which time the fog had dutifully lifted. The aircraft got safely airborne only to crash a few minutes later killing all 80 persons on board. The investigation revealed that shortly after takeoff an overheated wheel exploded in a wheel well rupturing a hydraulic line and causing the aircraft to catch fire.

Got the message? We don't expect pilots to work out snap calculations of KE and BTUs every time they apply the brakes, but to avoid the stench of molten metal, smouldering rubber, and the slow burn of the supervisor, you should utilize, at all times, such decelerating devices as the dragchute, aerodynamic braking and reverseable thrust. These are your primary braking devices. When you do resort to wheel braking, don't assume since you had no trouble stopping that you've got it made – maximum heat in the wheels is not reached until 25 to 30 minutes after the stop. ★



TED DISCUSSION



Why use the drag chute during an abort? Here's why. During this stop brakes generated 1½ times more heat than they were built to withstand.

BROWN SHOE CLICHÉ

By Major Moses R. Box
Directorate of Aerospace Safety

Back in the old "brown shoe" Air Corps there used to be a saying, "You look after your men and they'll look after you." The color of the uniform has changed and some people seem to think the cliche has changed, too. But, believe me, it still holds true with the "Blue Suiters." If you are the supervisor (and if you are not, no time like the present to start preparing) and can get your men to cooperate with you in doing a good job, YOU are the one who gets the credit.

If you aren't getting the cooperation you should, don't simply blame your people. Run a checklist on yourself. Maybe:

- You don't help others.
- You break your promises to your men.
- You throw your rank around and have a superior attitude.
- You "ride" your subordinates.
- You pass the buck (both up or down)
- You show partiality and favoritism among your men.

This list is not all inclusive, it's a sample to emphasize the point that you don't get cooperation from others unless you yourself cooperate.

"I can't make you do that, but I can make you wish you had!" was another old brown shoe cliche. Sure, by using coercion and threats you can probably get your men to do their job, but you won't stimulate much interest for their jobs or foster a spirit of cooperation.

Cooperation depends on attitudes and past treatment. Taking the positive approach to the above negative characteristics, we come up with the following suggested actions for all supervisors:

- Be fair in dealing with your men.
- Make constructive suggestions, but don't "nag."
- Show consideration for your men.
- Always keep your promises if at all possible; when not possible, explain why.
- Maintain a truly open-door policy.
- Take a sincere interest in your men and their activities.
- Assume responsibility for the actions of your men and the actions of your supervisors; i.e., don't pass the buck either up or down the chain of command.
- Take responsibility for your actions and admit when you have made mistakes.

What does all this cooperation have to do with safety? No matter how much coercion is used, safety becomes a fact and way of life ONLY when your men want to work with you and help you do your job.

How is safety reflected in an Air Force unit? Some units wait for a rash of accidents to break out, then they go to work to prevent similar accidents. This results in a periodic letup of the emphasis on safety, with spurts of activity at accident prevention. The accident rate chart looks like saw teeth.

Although not as spectacular as the all out drive *against accidents*, the approach of being *for safety* can be very effective. The supervisor must talk and live safety. He must set the example. We talk operational readiness, cost and quality control, so why not include safety? A supervisor can make safety a part of every meeting and briefing and never run out of material. Here are a few subjects, as examples: Material handling; man-machine interfaces; the use and care of tools; good housekeeping practices to prevent fire and injury; traffic within your area; the use and care of protective clothing and equipment and electrical hazards.

To hold the interest of your men, concentrate on the tools, equipment and areas which affect them. Another "attention getter" is encouraging participation in safety discussions. Don't lecture your people; get them to discuss their problems and experiences. Before long, these safety meetings will become safety conferences with stimulating inputs by all. Here are suggested tips:

1. Get participation first by asking for it; then by calling on others to contribute their ideas.
2. Let others lead the discussion; this is excellent for motivation. Outside assistance, such as contractors and Air Force engineers, would also be helpful.
3. Demonstrate and use visual aids. This is much more effective than straight talking.
4. Where special safety problems are involved, discuss them with the small group concerned — not with everyone.
5. Form a Safety Committee, assigning new men every few months so that everyone gets the experience. Also, give committeemen badges or pins of some type to identify them. This committee should be a working group, reporting on accidents and safety hazards.
6. Don't forget reminders. Use safety posters, and change frequently.

These are just a few suggestions you, the supervisor, can use to encourage safety in your unit. Set the example, then solicit help from your people: You can't do a complete job by yourself, but if you are safety oriented, practice safety at every opportunity and instill cooperation in your people, you won't have to spend much time explaining accidents. ★

FAA ADVISORIES

b Terneuzen
A Liaison Officer
ectorate of Aerospace Safety

WHAT'S NEW IN SINGLE FREQUENCY APPROACH (SFA)—The USAF and FAA have been working most diligently for the past few years to hurry the installation of equipment necessary to provide SFA service. As of 8 March 1965 the following priority one USAF bases were all that remain to complete this phase:

Base	Per Cent Completed	Estimated Completion Date
Charleston	0	1/11/65
Dayton/Clinton Co.	20	30/ 4/65
Davis-Monthan	90	18/ 3/65
Ellington/Houston	20	1/ 4/65
Kelly/San Antonio	0	1/11/65
Lockbourne/Columbus	75	30/ 3/65
Moody/Valdosta	5	14/ 5/65
Nellis/Las Vegas	98	18/ 3/65
Olmstead/Harrisburg	70	30/ 6/65
Perrin Rapcon	0	15/ 4/65

Langley, Lincoln, Little Rock and Olathe (Richards-Gebaur) have recently been completed.

Installation programs at priority two bases will begin just as quickly as priority one bases are completed and funds are procured. Priority bases are:

Byrd Field/Richmond
Fresno
Grand Island
Kirtland
Logan
Niagara Falls
Phelps Collins
Portland
Siskiyou County
Truax
Toledo Express
Volk Field
Walla Walla
Wright-Patterson

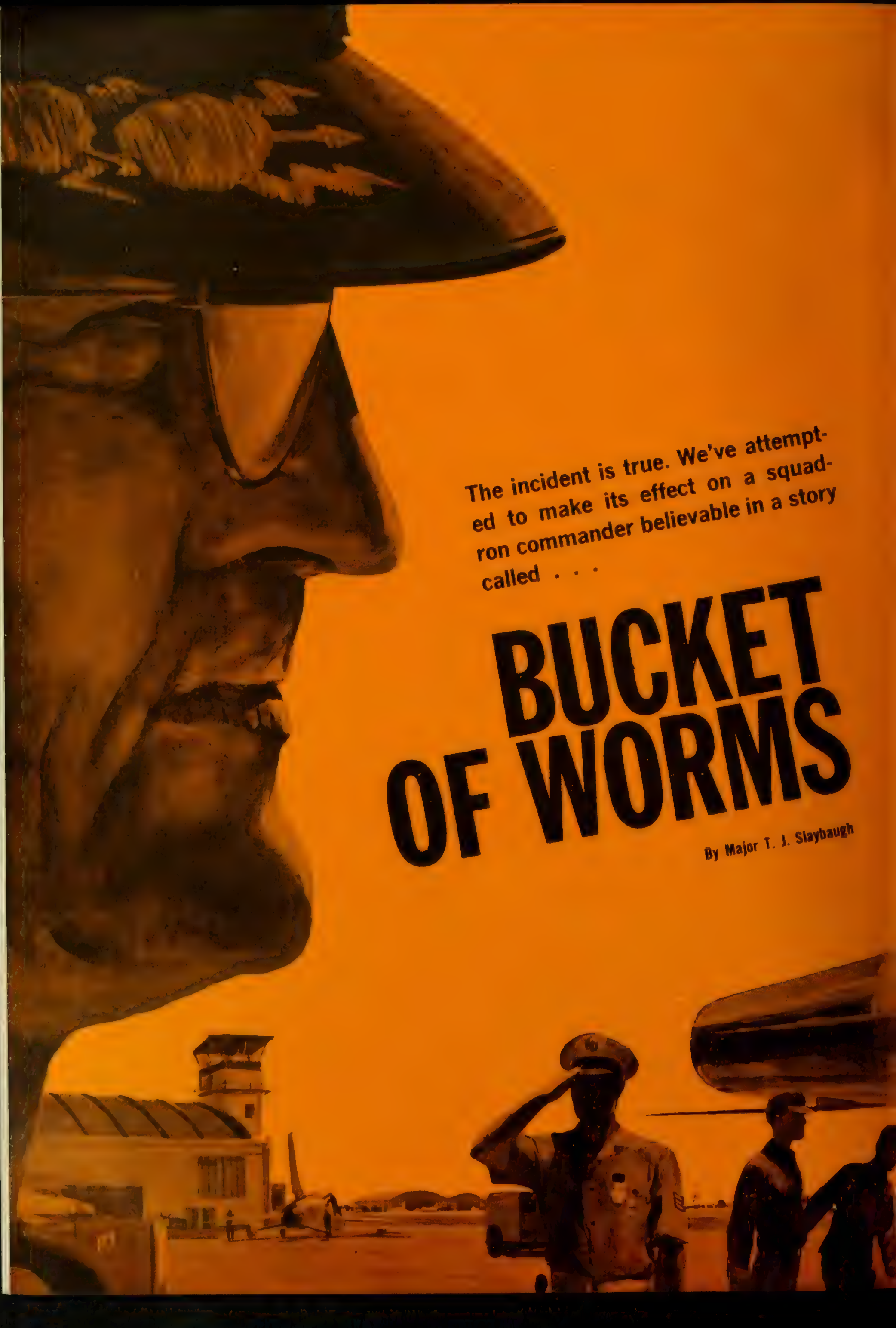
Priority three bases are:

Bakalar
Buckley
Dobbins
Forbes
General Billy Mitchell
Hutchinson
Maxwell
McCoy
Peterson
Pope
Sewart

RETENTION OF VOICE RECORDING TAPES. The FAA formerly retained air traffic voice recording tapes for 30 days. This retention time has been reduced to 15 days, unless connected with a specific accident or incident.

To assure that all facts are available when USAF personnel consider it necessary to file Operational Hazard Reports involving FAA air traffic services, prompt reporting and processing will be required. Too often in the past tapes had already been demagnetized because reporting personnel did not act promptly.

Now, more than ever, timely reporting of hazardous operation is essential if corrective action of valid complaints is to be accomplished. ★



The incident is true. We've attempted to make its effect on a squadron commander believable in a story called . . .

BUCKET OF WORMS

By Major T. J. Slaybaugh

Missilanea

ACCIDENT PREVENTER. Second Lieutenant Inocencio De la Cruz, assigned to Hq SBAMA as an ICBM development engineer for Titan II, was called to a site for technical assistance in the malfunctioning of the missile prevalves. While on this assignment, he noticed that an oxidizer hose assembly is connected from the rocket engine oxidizer discharge line quick disconnect to the oxidizer facility drain. According to instructions, the oxidizer N_2O_4 is gravity drained and dumped into one side of the "W" flame deflector without being neutralized. Also, a fuel hose assembly is connected from the rocket engine lube oil cooler quick disconnect to the fuel facility drain. Again according to instruction, the fuel Aerozine-50 is gravity drained and dumped into the other side of the "W" flame deflector without being neutralized. Research of the Silo Operational as-built drawings revealed however, that the two four-inch drain pipes installed (one on each side) at the bottom of the "W" flame deflector drain to a *common sump.* Consequently, the hypergolic propellants may ignite and explode upon contact in the common sump.

Thanks to Lt. De la Cruz' observation and report, the Systems Support Manager was alerted and mods as necessary to eliminate the hazard are anticipated.

Maj Gene G. Halvorsen
Norton AFB (SBNEPB)

WHEREZIT??—Probably every car owner has experienced the shock of having his keys locked inside his automobile. Such carelessness often creates considerable inconvenience and embarrassment, but is seldom a hazard. However, the same is not true with a missile weapon system. Recently, a helpful missile maintenance technician (MMT) opened a Minuteman launch facility for a contractor-installed modification. The accommodating MMT was so eager to assist that he rushed through the prescribed sequence of operations. Apparently the checklist was a retardant, so he placed it in a secure place and relied on his memory. The checklist was so unimportant to the MMT that he inadvertently left it within the launcher!!!

Fortunately, the silo was secured without mishap. But, alas! Another entry was required. The MMT possessed great skill and confidence. He reopened the launcher—again without benefit of checklist or technical data (even though a technical order was in a nearby vehicle).

This MMT is a skilled (?) but careless workman. Does he work for you? Or, does he work against you?

Lt Col Valdean Watson
Directorate of Aerospace Safety

SAFETY FILMS—At the 5th Annual Safety Congress it was recommended that the Directorate make available safety films of 15 to 20 minutes duration, that are missile oriented and depict the roles of the Commander, the Safety Officer and supervisors in accident prevention. Missile Safety films, in color, available are:
TF 5600 MISSILE SAFETY SURVEY, 20 min. Instruction and guidance for commander and staff in planning, scheduling and conducting safety surveys.

•

TF 5437a MINUTEMAN WEAPON SYSTEM SAFETY—Introduction, 19 min. Familiarizes personnel assigned to operate or support this weapon system.

•

TF 5437b MINUTEMAN WEAPON SYSTEM SAFETY—Maintenance, 14 min. Stresses safety measures necessary to maintenance of the weapon system.

•

TF 5522a, b, c, d, e. MAN AND SAFETY, 27 min. each. A series of five films highlighting man's "built-in" limitations.

•

SFP 1139 THE USAF SAFETY STORY, 30 min. Historical development of the safety program from early Signal Corps days to the present.

•

FTA 510 A PIECE OF PAPER, 10 min. Teaches how to recognize, identify and report missile hazards.

Requests from ZI bases should be sent through local facilities to the AF Film Library Center, 8900 S. Broadway, St. Louis, Mo. Requests from overseas bases should be sent to the local film servicing unit or to the overseas central or branch film library listed in the AFP 95-2-1. ★

The only excuse for putting a human being in charge of an aircraft today is that he can do **one** thing machines cannot: **exercise judgment!**

moments of decision

By Lt Col William R. Detrick, Aviation Physiologist, Asst for Medical Services, DTIG

Most of the decisions made in an emergency or hurried situation are the right, or correct, ones. These are the times when everything turns out well and no one, except perhaps the man himself, is really aware that a right decision was made. Perhaps the individual is even criticized for making that decision.

There are other times when the decisions were the wrong ones. Or no decision was made. The accident files contain many such cases: A jet bomber lines up on the runway for a heavy weight takeoff. For some reason the pilot's actuation of the water-alcohol switch does not produce the required results for a full power, heavy weight takeoff. Rather than abort, he elects to continue the takeoff attempt. The big jet staggers off the ground as it runs out of runway, only to crash in flames a few hundred feet beyond, killing all on board . . .

A twin-jet fighter beginning a takeoff roll gets an afterburner light on only one engine. The pilot elects to continue. Several hundred feet down the runway, the remaining afterburner is observed to go out. Much later the takeoff is aborted but the aircraft crashes out of control off the runway. A pilot dies in the ensuing fire . . .

A century series jet fighter lands on the runway following the pilot's futile attempts to lower the landing gear. As the aircraft slides to a stop in a cloud of dust, the pilot is observed to be moving around in the cockpit. A few seconds later he ejects himself from the aircraft in a fatal attempt to blow the canopy, forgetting for a moment he was using a single-motion ejection seat on which the arm rest handle, when raised, fires both the canopy and the seat . . .

A flight of two jet fighters rolls down the runway for a formation takeoff. In an attempt to stay behind the flight leader the wingman asks him to "push it up" as he adjusts power to minimum afterburner. On rotation of the aircraft, the wingman actually passes the leader who drags the tail pipe of his heavy fighter in an attempt to force it into the air. Approximately 30 feet of altitude is gained before the aircraft quits flying and crashes . . .

The GCA final controller informs the pilot making an instrument approach that he is dangerously low on the glide path. The pilot replies that he has the runway in sight but crashes short . . .

> **No one gets ready for an emergency in a moment. What a person does in an emergency is determined by what he has been regularly doing for a long time.**
>
> **(SAFE WORKER, National Safety Council.)**

The pilot of a four-engine transport hurriedly orders his passegers to bail out when an engine fire is discovered, forgetting perhaps that is is night time and that the aircraft is over arctic waters. The aircraft lands safely after the fire is brought under control but all but one of the parachutists are lost in the icy water . . .

The pilot of a jet fighter ejects from his out-of-control aircraft just prior to impact. Although the ejection seat clears the aircraft, nothing short of an Atlas Booster could have counteracted the downward speed in time to save the pilot's life. His out-of-control condition had been reported at a fairly high altitude.

Now compare these examples to the many untold and unreported times when: Pilots have safely aborted a takeoff that did not seem quite right; a crash landing was made and the pilot meticulously turned off all switches and radios before safely abandoning the aircraft; two century series pilots successfully ejected seconds after takeoff and just prior to a crash caused by control malfunction; many times pilots have broken off approaches that didn't seem right, or went to an alternate when conditions were just about at minimums at destination.

My point is this: Although most hurried decisions are sound and correct, many are wrong — deadly so. How then do we make sound and correct decisions under stress?

All decisions, whether studied or hurried, should be based on careful evaluation of the circumstances. Sounds easy, but how about when the situation is blowing up around you and action must be taken NOW? The only answer is that hurried decisions must be at least partially thought out ahead of time. This implies a thorough knowledge of the aircraft and its performance as well as some idea of one's own abilities and limitations. This is where education and training come into play. This is the reason for set procedures, technical orders and standard operating procedures. Pilots well drilled in emergency procedures usually react with little or no delay during emergencies.

During emergencies decisions must be made quickly, while there is still time for the pilot's actions to produce correct results — aborting the takeoff early, ejecting while there is still enough altitude to get out safely, starting a go-around from a bad approach while time and altitude remain to do it safely.

Have you trained yourself to the point where you can answer the following questions to your own satisfaction? What would I do if the engine quit now? What would I do about an inflight fire? What if my destination is socked in?

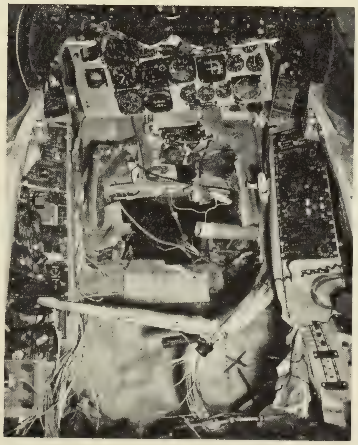
As students we were all pretty alert for possible forced landing sites, since we never knew when the instructor might pull off the power. What do you plan to do if an engine quits just after liftoff and you have no more runway ahead and insufficient altitude and air speed to eject? Do you have an alternate decision as well as an alternate airport at all times?

If you have the emergency procedures cold and have thought through all of the possibilities ahead of time, the final decision — that critical, make-or-break one — will be much easier. The attitude "it can't happen to me" has probably killed more people than we'll ever know.

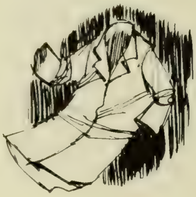
Preparation is the key to those critical Moments of Decision. ★

Don't Ditch the Centuries

Here's what happens when a jet fighter ditches under near ideal conditions. At approximately 1500 feet, after takeoff, the engine flamed out and couldn't be restarted. The pilot ejected successfully and the aircraft ditched in a generally good ditching attitude. Later a diver took these pictures of the aircraft, upright, in 38 feet of water. Note that damage was extensive, the fuselage broke at the cockpit area and the nose section folded under. The cockpit floor was completely destroyed by impact, the engine intake being forced into the lower cockpit area. ★



Aerobits

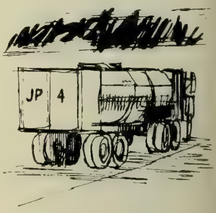


STATIC RAINCOATS. It has been discovered that the new Air Force issue raincoat (man's coated nylon twill) generates excessive amounts of static electricity when worn. This hazard is considered tolerable, provided the raincoat is worn as intended — as a dress item of issue. It is not intended for wear on the flight line or in hazardous environments where ignition sources are prevalent.

For persons performing maintenance or other duties in hazardous environments during inclement weather, Uncle Sam authorizes: overalls, wet weather, cotton sheeting, rubberized S/N 8405-725-2812 and rain jacket, cotton sheeting, rubberized, S/N 8405-682-6776.

WRONG JUICE. After having been serviced from a contract fuel facility, a C-124 was started and taxied out for a transocean flight. During engine runup the flight engineer noted abnormal engine instrument readings and that the cylinder head temperatures were approximately 20 degrees high. He informed the pilot. While they were discussing possible causes and actions they should take they were called by the tower. A B-50 had air-aborted and an after-landing examination disclosed that it had been serviced with JP-4. The tower operator advised that possibly the C-124 had also been serviced with JP-4. The C-124 was taxied back to the ramp where tanks 2, 5, 8 and 11 were found to have been serviced with approximately 6000 pounds of JP-4. Although all circumstances are not known, masking tape had been used to cover one side of the truck, which had "JP-4" painted on it.

Moral: When instruments don't read right — there's a reason. Find it!



CHUTE SHOCKER. During an ORI a pararescueman jumping from 1000 feet noticed a delay in parachute deployment. Then, when the chute opened, all of the suspension lines to the right front riser connector link came loose. Since there was no significant change in the rate of descent, the parachutist did not deploy his reserve chute and descent and landing were normal.

Later it was determined that the yoke on the right front connector link apparently slid off on chute opening. But here's the shocker! The yokes from the right rear and left front connector links were also missing, and, although the left rear connector link yoke was in place, it slid off easily when checked.

This was a new, recently assembled chute with no evident defacing of the connector links. Therefore, it is apparent that the set screws were not tightened during assembly of the parachute. Whether the parachutist made the proper decision in not deploying his reserve chute is open to debate. The point we would like to make is that apparently an oversight caused this hazard. This emphasizes the need for constant surveillance by personnel in the business of handling vital life-saving equipment.

This same type connector link is used on most personnel type parachutes. In an emergency bailout or ejection there is no backup.

Robert H. Shannon
Safety Officer
Assistant for Medical Services, DTIG

UNSTUCK DIPSTICK—It took the combined efforts of Albuquerque Center, the New Mexico state police and the crew of a U-3B, but good work on the part of all prevented an accident. The mishap also provided a clue to a problem that had not been solved in several previous incidents.

Prior to flight, the crew was checking the aircraft and one of the pilots had trouble with the oil dipstick — couldn't get it properly inserted and locked. The crew chief then installed and locked the stick and the pilot noted that it was properly in place. As the flight neared Otto VOR east of Albuquerque, at 10,000 feet, the Nr 2 engine oil pressure dropped to zero, the engine began vibrating and the propellor surging. Since altitude could not be maintained on one engine, descent was begun and at Otto the aircraft was down to 8000. The crew queried Albuquerque Center as to altitude along flight route and was informed that the terrain got up to 7900 feet.

The pilot asked for airports and was informed that there was an abandoned strip four miles east of Otto VOR. By now the aircraft was down to 6500, so pilot advised that he would have to try a landing there. Darkness had set in so the Center called out the New Mexico police who sent some cars to the field. They parked their cars to provide lights from their headlights and a successful landing was made. Because of vegetation growing on the strip and location of the cars, the pilot actually landed on a sandy, overgrown piece of desert. After inspection and servicing the aircraft was released for flight.

Several similar incidents had occurred at this base and it was thought that the dipstick had simply not been correctly installed. In this case both a crew chief and pilot observed that the dipstick was properly in place; the real culprit was inadequate depth of the channel in the phenolic locking block. A recommendation has been made to secure a more positive dipstick lock.

SHORT RIGGING — As we were making the last pass, even the range officer complimented us on the mission. It was a fine feeling. All we had to do was go home. It looked like a perfect weekend.

It started as I was making my turn for rejoin. Nr 2 tucked it in. Nr 3 was closing and 4 wasn't far behind. Nr 3 dropped his boards to slow down and he dropped back. I was about to comment on the sloppy join-up when he called "utility failure."

Things went from good to not-so-good in a hurry. I sent Nrs 2 and 4 back, and got on Nr 3 to chase him home.

Utility failure in the F-100C isn't a dire emergency, but you have to lower the gear manually, you have no nosewheel steering and only three shots of brake. The wind was light and right down the runway. It didn't look like much sweat.

We had plenty of fuel so we took our time. I read the checklist (gear extension procedures) while he did it. We slowed to 220 knots. He put the gear handle in the down position and pulled the manual release. The main gear up locks released and the main gear fell out of the wells, down and locked. The nose gear remained up and locked. Now things started to look black.

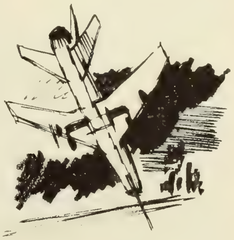
We called mobile to see if he had any ideas. He looked in the good book but we had already done everything.

Landing a tricycle gear aircraft three-point didn't appeal to Nr 3, especially when the nose was one of the points. We decided to try one more.

He gave a couple of thumbs, nose-up trim, let go of the stick and grabbed the release with both hands. Now wasn't a time to be dainty. After he gave a mighty pull, the nose gear came down and locked. After heaving a big sigh of relief (both of us) he landed without any further difficulty. When we investigated, we found the cable in the manual release rigged about a quarter of an inch too short. Only a very hard pull could release it. Because of this quarter of an inch we almost lost an expensive aircraft and possibly a pilot.

So remember, fellas, keep watching for those little things. They can kill you just as dead.

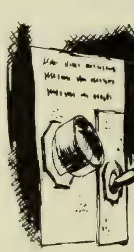
Capt Harold E. Buckley
131 Tac Ftr Gp (ANG)
Lambert Fld, St. Louis, Mo.



Aerobits

LOOSE SCREW — During preflight, controls checked okay, but on takeoff the pilot noticed the elevator control felt stiff. The copilot investigated and found a one-eighth by one and one-eighth inch screw lodged between the control column and the cover over the control cables. After considerable work, the copilot was able to remove the screw with his knife; however, while he was working the screw it became lodged in a vertical position which prevented forward movement of the control column. After the screw was removed normal operation was possible and the mission continued as briefed.

Apparently this screw was dropped during replacement of the copilot's airspeed indicator.



CASE BUSTER — Seems the pilot had started his T-bird and everything was checking out fine until he got to the emergency fuel check. At this time, the pilot inadvertently activated the GANGSTART switch instead of the EMERGENCY FUEL SWITCH. He realized his error and simply returned the gangstart switch to the off position without retarding the throttle. This action produced a very loud rumble and the engine was shut down. Investigation revealed a badly cracked engine compressor case caused by over-pressure in the engine compressor section.

The error made by this pilot is understandable since the two switches are located adjacent to each other. Therefore, it's important to remember that the gangstart switch parallels the function of the emergency fuel switch. Consequently, returning the gangstart switch to the off position must be done in the same manner as switching from the emergency to the normal fuel system.

ALL OPERATORS: Assure the throttle is retarded and the engine is in a coast-down condition when switching the gangstart system OFF or returning the emergency switch to NORMAL.

ATC Safety Directorate

HELP! — The Directorate of Aerospace Safety is frequently required to make presentations concerning *materiel* failures and *maintenance errors* in support of your field efforts.

A requirement exists for high quality, professionally produced 35mm color slides that may be used as examples of these irregularities.

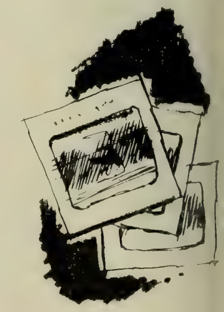
We need your help!

Request all suitable subjects be given professional photographic coverage by base photographers and that 35mm slides in color be forwarded to the Directorate of Aerospace Safety, Deputy TIG USAF (AFIAS-F3), Norton AFB, with a factual explanation of the circumstances surrounding the incident. In those cases where AF Form 711s have been submitted, only slide identification and a reference to the report is necessary.

Suitable subjects referred to above are not limited to, but should include such things as materiel failure, design deficiencies that hamper maintenance, improper maintenance and items received that indicate poor quality control at the source.

Your assistance in this effort will be greatly appreciated. ★

Lt Col Harold K. Boutwell
Directorate of Aerospace Safety



☆ U. S. GOVERNMENT PRINTING OFFICE 1965 751-220/11

# WELL DONE

1st LT. ROBERT L. CLINKENBEARD

2D FTR INTCP SQ, 52 FTR WG. SUFFOLK COUNTY AFB, N.Y.

On 8 April 1964, First Lieutenant Clinkenbeard took off in an F-101B from Suffolk County AFB, New York, on an operational deployment mission. Weather was 400 foot broken ceiling with one mile visibility in rainshowers and fog. Immediately after takeoff, Lieutenant Clinkenbeard experienced severe control difficulties. He immediately raised the wheels and flaps and climbed straight ahead. All instruments were in the green, but when he used ailerons the aircraft went into a violent dutch roll. He quickly climbed for altitude. The same control problem was encountered at all airspeeds. A gentle turn was initiated to determine controllability and the radar observer noted the left aileron fluttering in the turn. These flight stability tests were accomplished in very heavy weather at 3000 feet. Emergency position was selected on the aircraft transponder equipment and Suffolk GCA was contacted on Guard Channel. Lientenant Clinkenbeard experimented with the aircraft to attain the best control airspeed and configuration for landing. He followed GCA instructions and made a successful landing in gusty winds and marginal weather with a heavy aircraft. Maximum aerodynamic and wheel braking techniques were used to stop on the rainslick runway. Inspection disclosed that the aileron position transmitter was out-of-null.

The professional skill, knowledge of the aircraft, and calmness exhibited by Lieutenant Clinkenbeard in an emergency during minimum weather conditions prevented the loss of a first-line United States Air Force fighter interceptor aircraft. WELL DONE! ★

REPORT IT!

629.1305
FLYS

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SAFETY

UNITED STATES AIR FORCE

SEPTEMBER 1965

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FALLOUT

DISRUPTIONS. . . .

I've read Rex Riley's note "Disruptions, Disruptions" in the May issue and would like to have this incident viewed from a little different angle.

Perhaps the heading for this article should read, "Poor Planning." Disruptions 2, 2 plus, and 4 could have and should have taken place prior to the aircraft's entering the traffic pattern. Furthermore, the request to the tower (Disruption 2) is in violation of AFM 60-5, Par 2-3. Several locations have Pilot-to-Dispatcher (PTD) service available to provide direct communications to Operations. It is possible that the tower controller was busying himself with this pilot's request for a Non-ATC function rather than eyeballing the aircraft for abnormal conditions. Par 8-13, of AFM 60-5 would provide interesting reading for several of us.

Disruption number 3 is a mandatory transmission. (See FAA Manual of Air Traffic Control Procedures AT P 7110-1B, par 411, which is directive on USAF per AFM 60-5, par 1-1.)

Capt James F. Meyers
2025 Comm Sq, Hunter AFB, Ga

THE IPIS APPROACH

I certainly have enjoyed your new feature page "The IPIS Approach!" As a recent graduate, I am well aware of their qualifications to deal with the type of questions that so often go unanswered by instructors and examiners. Too often the answers given are "I'll look it up and let you know" or "Let's ask standardization," and little or nothing is satisfactorily answered. This page in your magazine will give everyone a direct line with the top authority. I have two questions . . . * * *

Capt Robert F. Wearley
1709 Tech Tng Sq
Tinker AFB, Oklahoma

Thank you for the kind remarks. You can expect answers from the school, and possibly both questions and answers published in AEROSPACE SAFETY as space permits.

SIMPLY PULL THE RING AND . . .

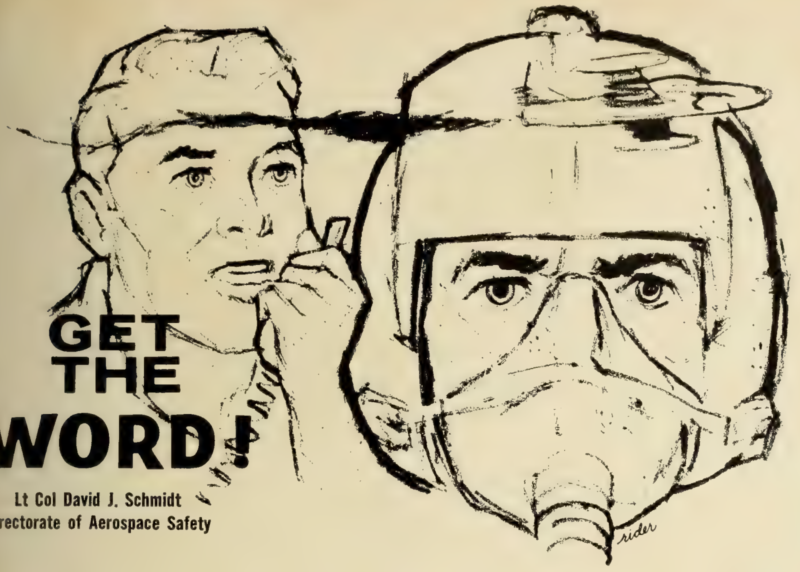
The following comments are forwarded to up-date the article "Simply Pull The Ring and . . . ," by S/Sgt Robert E. Brock, page 19 of the June issue.

T.O. 14D1-2-601, 4 March 1965, requires that the J-1 parachute release be assembled and maintained in such a manner that a *maximum* of 25 pounds dead pull will always activate the release.

Point being, if a greater than 25-pound pull is required to activate the release, then the chute with this release should never leave the Personal Equipment shop. Therefore, recommend that when you preflight your personal chute, if you feel the required pull to activate the quick release exceeds 25 pounds, make the Personal Equipment shop prove you wrong.

SSgt Felix L. Smith
MOAMA, Brookley AFB, Ala

Good point. But preflight of quick release should be done in the PE Shop.



GET THE WORD!

Lt Col David J. Schmidt
Directorate of Aerospace Safety

It is not uncommon for an aircraft accident investigation board to find that a pilot or crew could have ejected and escaped the impact area of an aircraft crash if they had been warned in time.

Some control towers have the communications capability to transmit and receive on departure control frequency and the "saves" they have effected are, no doubt, numerous. But we rarely, if ever, hear about them. We are recipients of tragic news that another crewmember perished because no one could get through to him on the radio and he acknowledge in time to take life-saving action. For example, an aircraft made a second takeoff attempt after an abort in which the drag chute had been deployed but not jettisoned. The Supervisor of Flying and tower operator helplessly stood by watching disaster develop when they were unable to "get through" to advise the crew to abort.

More recently, the fuselage of an aircraft became engulfed in flames shortly after takeoff. Fuel in an aft fuselage tank ignited about the time the aircraft lifted off the runway. The tower operator advised the crew on guard channel that their tail was on fire but received only one aircraft transmission that was heard: "What's on fire?" The tower operator repeated his warning message but to no avail. Of the four crewmembers aboard, the copilot was the only one to eject, but too late to escape the fire pattern of the crashing aircraft. All four suffered fatal injuries. This airplane had attained an altitude of approximately 1100 feet and about 180 knots — above the emergency minimums for successful ejection. But —the crew just didn't "get the word."

Air Force Communications Service has encouraged base commanders to provide their control towers with the added capability for tower operators to transmit and receive on departure control frequency. This enables the pilot to respond directly to the tower operator on departure control frequency in the event of an emergency during or shortly after takeoff. At present approximately 60 per cent of the Air Force control towers have the capability to override on departure control frequency and "get the word" to the pilot during takeoff. It would be impossible to estimate how long it will take to so equip the remainder.

AFCS provides us with control tower operators and issues their operating procedures, but not the equipment. Their procedures require normal tower frequency coverage plus either two-way departure control coverage, or departure control reception monitoring plus transmissions on Guard. The standard instructions issued by control tower operators, before an aircraft commences takeoff, are to switch to departure control frequency before takeoff and monitor guard channel.

Several articles have been written on the use and misuse of guard channel, which has at times been referred to as a sort of "International Common" frequency, and it is obvious that non-emergency chatter still clutters up this frequency to a point where critical emergency instructions may not get through.

Until such time as all USAF control towers have this dual capability, it behooves every crewmember to be particularly attentive to departure control frequency and guard channel throughout the takeoff and climb portion of his flight. This is awfully cheap insurance where the only premium is "open earballs" and catastrophe may be the penalty for inattention. ★

Too Much Togetherness

During the two-year period 1963 and 1964, Air Force aircraft were involved in 43 midair collisions. Twenty-three of these were classified as major accidents, 11 of which involved USAF crew fatalities. That's one major accident a month and a fatal accident every two months, sufficient to confirm that we have a major problem. Fortunately, the solution may not be as difficult as it may seem at first glance. Only 7 of these midairs involved aircraft were not in some way associated, i.e., refueling, flying formation, intercepts. However, a broad recommendation such as "keep your eyeballs out of the cockpit," won't suffice.

For example, the problems during refueling range from poor pilot technique to altimeter discrepancies, with others in between. The interceptors have their own set of problems, and formation flying involves several commands, each with its own set of peculiarities in addition to those that are common. For those who think formation flying is formation flying and that's that, consider the problems involved when undergraduate pilot students are flying formation acrobatics. This is quite a bit different from experienced heads flying formation in tactical fighters. Here are some f'r instances.

A flight of six F-100s were on a night refueling and navigation proficiency mission. Due to various factors, including one pilot who lost his radios, two of the aircraft collided and both pilots had to eject. The events immediately before the collision were essentially as follows: Nr 5, the one without radio, was on lead's left wing. To his left was Nr 6, who had been Nr 5's wingman but who had been instructed to move up and lead Nr 5 in to a landing. Unfortunately Nr 5 didn't know this. While trying to attract lead's attention he had closed in and tried various methods including a pen light, fuel probe light and the cockpit utility light. When he moved back out to his left he was not aware that Nr 6 had moved up, and his aircraft collided with Nr 6. Prior to impact Nr 6 simply thought Nr 5 was moving over to join up on him.

The pilot of Nr 6 aircraft was tagged with the primary cause — because he assumed Nr 5 was joining on him and he did not take evasive action. A dissenting member of the investigation board argued that it was not the fault of the individual pilot but rather supervisory error in that night formation procedures with lost communications were inadequate.

Another kind of formation flight provides a sharp contrast. A pair of T-Birds, one occupied by a solo student, were flying formation acrobatics. During an Immelmann, Nr 2 (the student) encountered the jet wash of lead and failed to follow through on the rollout. This put him inverted above lead at 7 o'clock. With lead straight and level, the student tried evasive action by pushing forward on the stick and rolling to his right. He crossed over lead from left rear to right forward in a rolling, descending motion. His left tip tank struck the right tip of lead, tearing off both tip tanks. After controllability checks both aircraft landed safely. The primary cause was determined to be operator error on the part of the student for failure to maintain spacing.

To further complicate matters here's another case with a little different twist. An F-104 was on a check flight with a like aircraft flying chase. Lead had some difficulty so he asked the chase pilot to inspect the under part of the aircraft. Meanwhile the chase pilot had fallen out of position so he rammed on the coal, overrunning lead from below and right to left. While overrunning the leader he attempted to look up and inspect the other aircraft. Result: as the chase aircraft crossed in front of lead, the left horizontal stabilizer of chase hit the right side of lead's nose section. Fortunately the damage to both aircraft was minor.

In assessing the primary cause, the investigators decided that the chase pilot exhibited poor technique in attempting to visually check the other aircraft while crossing and overrunning. As a result, all pilots were to be rebriefed on formation techniques and a procedure would be established for making visual checks.

Here's another midair labeled pilot factor, but, as usual, there were some extenuating circumstances. As the formation headed home from the range one of the jocks was having trouble closing his MN-1A dispenser doors. The formation spread out while he attempted to get the doors closed. As the doors finally closed the pilot realized that he was sliding into the aircraft on his left. He made a last-moment rolling pullup but the gun bay of his bird struck the wing tip of the other aircraft. It just happened that while this was happening the other pilot was scanning the area in the opposite direction and didn't see the aircraft sliding into him. Again, they were lucky — only minor damage.

The finding of the Board was that the pilot with dispenser trouble was responsible because he became preoccupied with closing the dispenser doors while flying formation. A contributing cause was that the complicated system for MN-1A doors invited pilot preoccupation.

REFUELING

Now let's look at a couple of refueling mishaps. In one case an F-4C was rendezvousing at night with a KC-135. Before he had reached the correct offset for completion of the rendezvous, the F-4C jock called for the tanker to turn on course. This resulted in a stern chase and the fighter had trouble with the tanker's wing wash. After a couple breakaways, the fighter came in for a third attempt. At this point the boom operator noted that signal coil continuity was lost so he briefed the receiver on the manual procedure. As contact was made and fuel transfer begun, the nozzle light seemed to go out. Then the receiver pilot said there was a leak and the boom operator thought he saw fuel in the slip stream. As the receiver moved away the copilot of the tanker noticed that hydraulic pressure had gone to zero. The boom was then retracted and stowed using the emergency hoist pump. Fuel dumping, however, was unsuccessful.

In this case the fighter tried contact for 25 minutes, which exceeded the fighter on-fighter off and abort point, without making a successful contact. During one of his attempts to hook up, the fighter rammed the tanker boom ice shield breaking the hydraulic line to the dump finger. Loss of hydraulic fluid caused loss

of boom control. Lack of proficiency on the part of the receiver pilot was blamed for this mishap.

During another night refueling between a KC-135 and an F-105, the tanker boom lower nozzle light went out and the boom operator advised the pilot to close very slowly for the last five feet. (Two other aircraft had fueled with the light out without difficulty.)

As the boom operator attempted contact the fighter was overshooting slightly and the operator couldn't see the end of the boom. The '105 backed off for another try and encountered light turbulence. At the same time the boom struck the aircraft, inflicting a 20-in gouge in the panel beneath the air probe door and breaking the outer glass on the left forward windscreen. Cause factors: lower nozzle light inoperative; pilot of receiver overran; boom operator did not keep the boom clear; insufficient light from the receiver; lack of procedure.

Action was to restrict night refueling with the lower nozzle light out except in emergencies.

Fortunately, these accidents resulted in only minor damage. There have been more serious refueling accidents recently, one in which an F-105 was lost and another in which a B-47 and its crew went into the ocean. A few years ago a B-47 collided with a tanker with only one person surviving from the bomber, which crashed in a remote area.

Interceptors, too, have their problems. In the past two and a half years there have been five major accidents involving collisions during intercepts. But here the rule of see and be seen is complicated by another factor. Four of these collisions occurred at night when the only real reference was radar. Granted that scope interpretation is somewhat more difficult than visual location, pilots must nevertheless accept full responsibility for providing clearance during these required and intentional close passes. Precise range, azimuth, and elevation information is clearly presented on the same scope as that steering dot. Yet, in case after case, pilots have become so overwhelmingly preoccupied with a dead center dot that they have ignored this vital information. While a centered dot is admittedly the "name of the game" both for peacetime filling of squares and for combat effectiveness, we have yet to issue a requirement for a ram follow-up to insure the kill.

These examples could continue for many pages, but only one more will be presented, this one because it points up, tragically, how various ingredients combined to almost guarantee an accident. These ingredients were:

- Mixing a high speed fighter aircraft with slow aircraft at low altitude.
- Aircraft design which made it difficult for one of the pilots to see the other aircraft.
- Failure of one of the pilots to make sufficient effort to observe the other aircraft.

This accident occurred when a fighter, returning from a low level mission, collided with a helicopter. The chopper crashed and the fighter pilot was forced to eject.

Study of the accident factors indicated that the primary cause was that the pilots simply didn't see each other's aircraft. But consider the other factors: penetration and approach required much of the fighter pilot's attention in the cockpit; shortly before the collision the fighter was descending, which placed the olive drab chopper against a background of winter terrain, very effectively camouflaging it; for 30 seconds or more there was nearly a constant relative angle between the converging aircraft; relative motion was almost zero.

To further complicate the fighter pilot's job, this aircraft has a pair of windscreen supports that block his vision from 6½ degrees to 12½ degrees each side of a line from the pilot's eyes to the center of the windscreen. Therefore, at a distance of, say, 8000 feet the blind spot on one side would be 850 feet. The only way to compensate for this is not by merely swiveling one's head, but by a combination of swiveling and back and forward motion of the upper part of the body.

While the majority of the midairs during the past two years were attributed to pilot factor, the corrective action in most cases could be summed up as the need for (1) air discipline and (2) better supervision.

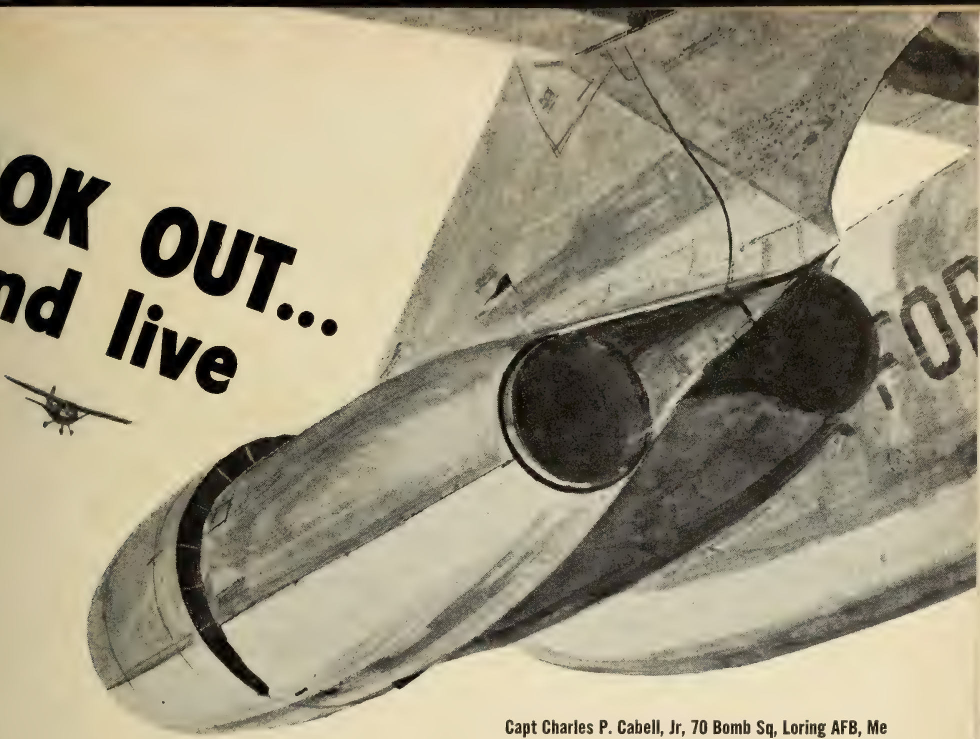
Now these two terms are admittedly broad and extremely general, and, like a thick coat of makeup they cover a lot of sins. In essence, though, most of these accidents and incidents could have been prevented by heads up flying on the part of pilots and a lot of improvements in procedures at levels higher than that of the man in the cockpit.

What's the midair picture for tomorrow? In every investigation of a midair collision, such as those recounted, recommendations are made: modify procedures, discontinue or alter the more hazardous elements of certain operations, provide better guidance — these are representative of efforts to cut down the number of midair collisions. Very possibly, many midairs have thus been prevented.

However, the eight major midairs in the first four months of this year do not indicate such progress. In fact, the average is running about double that of 63-64.

Don't be disappointed if you don't get specific answers here. The only valid solutions must come from the users of the aircraft. Involved are several commands, and people of varying experience and ability. Obviously, some procedures need improvement and others should be examined. But no matter how much tactics and procedures are changed, the real hope for greater protection from midair collisions tomorrow, especially between associated aircraft, rests largely with the men in the cockpits. ★

LOOK OUT... and live



Capt Charles P. Cabell, Jr, 70 Bomb Sq, Loring AFB, Me

We had just completed a bomb run on Oilburner "Orange Tree" (a SAC low-level navigation and bombing route which is laid out in Kentucky between the Newcombe VOR and the Lexington VOR). Richmond Bomb Plot cleared our B-52 to turn and climb to racetrack altitude for another bomb run. We leveled on the crosswind leg at four thousand feet, a thousand feet below an overcast, and I, the copilot, copied the post-release information from the navigator and started to relay the data back to the bomb plot for a score. At that moment the pilot tapped me on the arm, pointed, and swung the airplane down and 30 degrees to port. He was pointing at a Cessna 172, on a collision course with us and right on our altitude. The Cessna pilot took no evasive action and probably never saw us.

The point of my story is not to fix the blame for near-collision but to illustrate the need for reviewing what happens when you descend from high altitude.

At altitudes above FL 240 you are separated from other aircraft horizontally, by RADAR. All aircraft fly under Instrument Flight Rules with a standard 29.92 altimeter setting, and are vertically separated by one thousand to two thousand feet. As you descend below FL 240, your IFR clearance clears you vertically from other IFR traffic *only*. Some of the traffic is VFR. There probably is no RADAR separation, and your vertical separation has been reduced to five hundred feet. Bear in mind also, that below FL 180 you no longer fly with a standard altimeter setting, and your theoretical clearance depends upon how current your altimeter setting is.

Remember too, that as you descend the density of air traffic increases enormously, and not all of these low-flying pilots have the experience or equipment that their higher flying brethren do, nor are they required to have them. A student pilot needs only eight hours to solo, and his airplane need not be equipped with transponder, radio, anti-collision light, or other sophisticated traffic control devices. Chances are he will have his head buried in the cockpit more than would a more experienced pilot, and he will be relatively unconcerned, during transition, with maintaining proper quadrantal altitudes. The Airman's Information Manual (formerly The Airman's Guide) lists all of the SAC low-level routes, but how many civilian pilots actually heed their restrictions?

What I've been building up to is that the human eye scanning outside the cockpit is the best traffic separation device for most low altitude applications. Your eyes can overcome the potential hazards brought on by the lack of RADAR separation; by local altimeter errors; reduced vertical separation; by increased traffic density; and by sharing the airspace with simply equipped planes and inexperienced pilots. Our eight-engined Goliath could have been felled quite easily by a one-engined David. Look out and live! ★

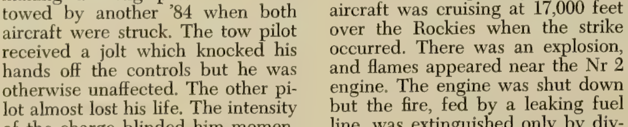
Lightning... HAZARD OR NUISANCE?

**Lt Col Jerry Creedon, AWS Liaison Officer
Directorate of Aerospace Safety**

Lightning has long been considered a nuisance but not much of a hazard to aircraft in flight. But the Air Force as well as other aircraft operators, the FAA and CAB are beginning to wonder if the hazards of lightning strikes aren't greater than previously thought.

In June of 1964, an F-84 was making a firing pass on a dart towed by another '84 when both aircraft were struck. The tow pilot received a jolt which knocked his hands off the controls but he was otherwise unaffected. The other pilot almost lost his life. The intensity of the charge blinded him momentarily and the jolt numbed his left arm and leg causing him to lose control of the aircraft, which went into a descending right spiral. Disoriented, he thought the aircraft was in a left spiral. Realizing this pilot's condition, the tow pilot joined on his wing and talked him into a pullout less than 3000 feet above the ground.

Another case, last August, involved a C-97 which caught fire as the result of a lightning strike. The aircraft was cruising at 17,000 feet over the Rockies when the strike occurred. There was an explosion, and flames appeared near the Nr 2 engine. The engine was shut down but the fire, fed by a leaking fuel line, was extinguished only by diving the aircraft at maximum allowable speed. Although the left flap was nearly destroyed by fire, a successful no-flap, three-engine landing was made on a 5400-foot runway at an elevation of 4800 feet.



Lightning started Nr 2 engine fire that endangered this C-97 while cruising at 17,000 feet. Increased airflow, during dive, finally extinguished flames that caused great damage to left flap.

While reports of aircraft damaged by electrical discharges are increasing, it is certain that many more aircraft are damaged than reported, since most occurrences are reportable under Para 4d (8) AFR 127-4 as "events considered to be worth reporting as an aid in preventing aircraft accidents." (OHRs are now required on all lightning strikes and electrostatic discharges by Para 29c, AFR 60-16B.) During 1964 there were 45 AFR 127-4 reports, and through May of this year there were 36. Apparently there is no "season" for electrical discharge, consequently it appears 1965 will record an impressive number.

The most common USAF aircraft electrical discharge event consists of the discharge or strike occurring at the nose radome and exiting the aircraft at a wingtip. The top of the rudder and protruding antennae are also frequently struck. C-130s lead the number of incidents with the C-124 running second. As would be expected, most discharges occur in the lower levels (near the 0° C. isotherm), over half occurring at 10,000 feet or lower, with the median at 8500 feet. The highest altitude reported was 34,000 feet.

STATIC DISCHARGE OR STRIKE?

Frequently it is difficult to say whether an electro-static discharge or natural lightning strike occurred. Apparently it makes little difference as far as the effects on an aircraft are concerned, although there is a theory that aircraft-generated discharges cannot produce the energy required to cause damage. Approximately half of the pilots submitting reports state they were in thunderstorm areas. Some reported stratus clouds with no precipitation, however, most indicated precipitation was occurring. Occasionally, discharges occur in the clear, after the aircraft has left a cloud deck.

Lightning phenomena as a hazard to aircraft are continually under study by both governmental agencies and private industry. Early this year a C-130 nose radome was struck while the aircraft was descending for landing. There was an explosion, followed by a fire in a pylon tank. Fortunately the fire extinguished itself on final approach just prior to touchdown. AFSC is conducting extensive research as a result of this incident. Recently the CAB determined that the probable cause of a commercial jet accident over Maryland in 1963 was a lightning-induced explosion in a fuel tank. These incidents serve to remind us of the possible disastrous hazards associated with lightning. Incidentally, it has been estimated that the airlines over the U. S. experience up to 500 electrical discharges per month.

GREATEST HAZARD

Fuel tank vents have long been suspect as a path for lightning (or lightning caused flame) to the potentially explosive fuel-air mixture in the fuel tanks. The Lightning and Transients Research Institute (LTRI) considers this to be the greatest explosion danger and recommends that fuel tank vents be located in areas least subject to lightning effects. As noted earlier, most lightning strikes occur near 0° C, where gasoline forms too rich a vapor-air mixture to explode and kerosene too lean a mixture. JP-4 vapor on the other hand, forms a more explosive mixture. Consequently, since a more or less precise combination of factors must exist, JP-4 is significantly more vulnerable to explosion than either gasoline or kerosene. Research in this area is continuing.

Lightning phenomena, while under extensive study, are quite controversial among pilots. LTRI says "Little can be done in the immediate vicinity of an aircraft to control whether it is struck by lightning, since the aircraft, which is relatively small, can have little effect in determining the overall stroke path which may extend for several miles." Yet, many experienced pilots say the aircraft is a specific factor in helping set off electrical discharges.

LTRI says that all discharges which cause damage to an aircraft are lightning strikes which terminate at the ground or in another cloud. LTRI also says that static discharges are not capable of damaging even thin aluminum. Many pilots feel differently. Some airline pilots of over 20 years experience state they have never experienced a natural lightning strike. LTRI is producing valuable knowledge about the effects of lightning on aircraft, using both artificial lightning strokes in laboratory conditions and the study of natural lightning. Their research vessel THUNDERBOLT operates out of Miami, Fla.

Note damaged rudder of C-124. Aircraft was struck while flying below 10,000 feet.

T-38 LIGHTNING STRIKES

The troops were on the last leg home on a navigation proficiency flight. The weather forecast included a few scattered (there is no such beast—a few is 5 to 15 per cent, scattered is 15 to 45 per cent) thunderstorms to FL 450. While cruising at FL 350, the pilots entered light cirrus. In a few minutes the clouds became thicker and turbulence was encountered. The front seat pilot saw three lightning strikes on the nose of the aircraft. The pilots climbed to FL 390 after clearance was received from center. Center confirmed tops of clouds at FL 450.

After the lightning strike the compass card precessed 50 degrees from the magnetic compass. The airspeed indicators dropped to 150 KIAS then to 130 KIAS. With the help of the center, the aircraft was vectored to another T-38 base for letdown at the home field. During the VFR letdown the airspeed indicators dropped to zero, but came back to normal readings in the traffic pattern.

The pitot tube had two burn spots; the rudder had one. The nose cone had a small chip from one strike. The magnetic azimuth detectors leaked but it could not be determined if that was caused by the lightning strike.

Center radar cannot steer you around lightning, and normally they have their radar polarized so they can't even steer you around a storm. The best plan, and incidentally the one used by those who have tangled with thunderstorms, is to give them a wide berth. You CANNOT do this flying in cirrus clouds in an area known to be populated with thunderstorms. This holds true whether they are forecast isolated or numerous—over 45 per cent.

ATC Approach to Safety

While we have chalked up most of our electrical discharge experience as no more than incidents, it is apparent that potentially hazardous conditions exist. Furthermore, in view of past USAF experiences, it is apparent some "incidents" were actually sobering events which bordered on catastrophy. Consider the B-57 making an instrument penetration in a thunderstorm with the field reporting near minimums. A lightning strike punched off one tiptank shortly before touchdown. That one could have been a disaster except for professional crew performance. A flight of four F-4C's were passing between thunderstorm cells. Cloud-to-cloud lightning was observed passing through the formation. Two of the aircraft flamed out, although both made immediate restarts. The lightning strike was suspected of causing a temporary interruption of engine airflow. This incident occurred at FL 340.

To one F-105 outfit in Germany it must seem for sure that lightning can strike twice in the same place. This unit experienced five strikes in two consecutive days in April this year.

As a caution, do not let lightning or static discharge lead you to a false conclusion. Case in point: The left engine of a transport failed and was feathered. A few minutes later it appeared that lightning hit the aircraft and soon the right engine quit. The crew bailed out. Accident investigators found that the inboard fuel tanks were empty and that the selectors were set on these tanks (outboard tanks were full).

Although Pilot Factor was the primary cause, two of the contributing causes are of interest in this discussion: 1) Weather, in that it assisted in leading the aircraft commander to false conclusions as to the causes of engine failure; 2) Mental Fixation, in that the pilot, copilot and flight mechanic temporarily acquired one particular line of thought to the exclusion of others.

We have discussed lightning at length but we haven't said what the pilot can do to avoid it or prevent major damage. Obviously there isn't much we can do. Avoiding thunderstorms is something we all try to do, but it is difficult to avoid *areas* of thunderstorms. We have little control in avoiding the 0° C. area where most discharges occur. It might be wise to remember that discharges frequently occur in continuous precipitation, not necessarily in thunderstorm areas. A most probable time of occurrence is during climbout or penetration when the pilot is most occupied with flying the aircraft.

We can look for reduction of the fuel-vent explosion problem in the current research being conducted. Use of flame-arrestor screens and lightning diverter rods are being investigated as are fuel vent locations. Since wingtips are frequently struck, bonding, shielding and location of external tanks are being studied.

In the meantime, our best bet is to avoid, when possible, thunderstorms, the 0° C. level when precipitation is present, and icing areas, particularly those producing rime. Continue to report electrical discharges and lightning strikes and the atmospheric conditions existing at the time, for these reports are invaluable to scientists trying to create the protection necessary to keep lightning a nuisance rather than a hazard. ★

CUT WITH MY OWN KNIFE

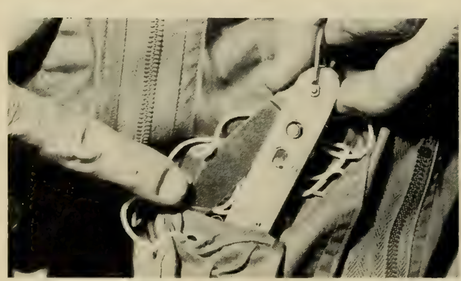


FIGURE 1

Here's a little tip from the PE troops. Don't just jam your survival knife into the pocket of your flying suit with the cord wadded every which way. (Fig. 1). A bump could release the blade, you might not be able to get the cord untangled when you need it, the opened blade could inflict an injury, or cut the cord and you could lose the knife. Here's a better way (Fig. 2). Wrap the cord neatly around the upper part of the case, leaving approximately six inches of slack, then, with the hook left open to be ready for the four-line cut, insert the knife into the pocket as shown in Fig. 3. *(Our thanks to Robert E. Brock, SSgt USAF, Ret., Norton AFB, Calif.)*

FIGURE 2

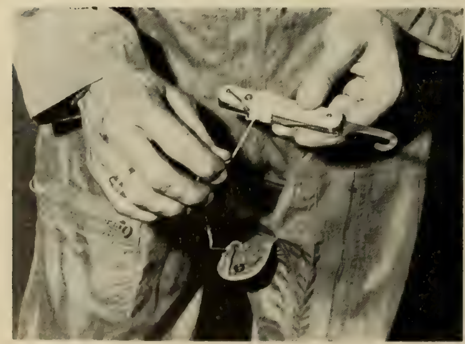
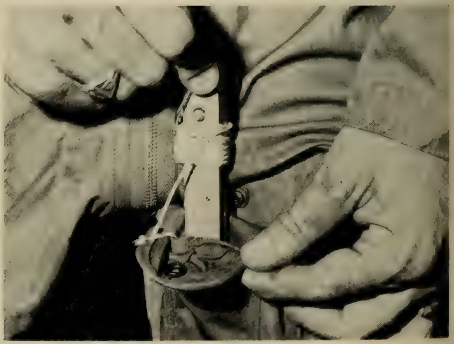


FIGURE 3



THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC), Randolph AFB, Texas

Q. **In the event a pilot flying in the low altitude structure requests and receives from ATC a VFR/OT clearance along airways, what minimum altitude must he comply with if an MEA is designated?** ***(Major Paul James, 1st CEG, Barksdale AFB, La.)***

A. Pilot should comply with VFR procedures prescribed by AFR 60-16, Par 33(a). Since it is the pilot's responsibility to maintain clearance from all obstacles, the MEA would not be mandatory.

Q. **The operational limits for interference-free area prescribed for an "L" VOR facility is 40 NM. Why is it that some airways are established using "L" facilities in excess of 40 NM?** ***(Captain Donald R. Brown, 4600 Operations Sq, Ent AFB, Colo.)***

A. Service Volume Areas (SVA's) apply to direct flights in controlled airspace within each route system and not necessarily to airways. Airways have been specifically route checked, and aircraft operating at or above the MEA will have no problem with interference from another facility. You will have to comply with the 80 NM distances between Nav Aids below 18,000 feet for IFR direct flights in controlled airspace. Controllers will not clear you unless they can provide navigational guidance.

Additionally, by requesting VFR/OT you can be cleared for a direct route of flight that does not meet SVA.

See FLIP II, page 91, and FAA ATC procedures manual ATC 7110.1B, Par 283, for additional information.

POINT TO PONDER

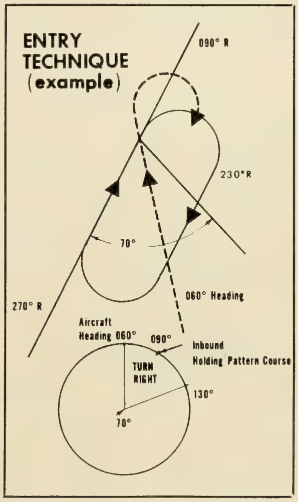
A convenient method to determine holding pattern entry has been suggested. It is submitted for your consideration.

Check 70 degrees to the right (left, for a non-standard pattern) of the aircraft's inbound heading at the holding fix. (For planning purposes, estimate this heading prior to reaching the fix.)

If the inbound course of the holding pattern is located within this 70-degree zone, the turn to enter the holding pattern is made to the right. (Left, for a non-standard pattern.)

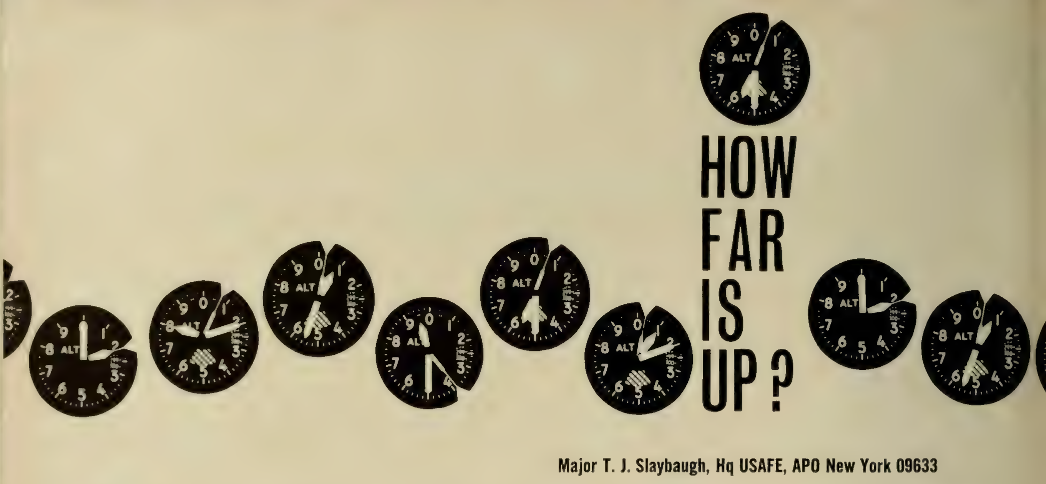
If the inbound course is not within this 70-degree zone, turn outbound in the shortest direction to parallel the inbound course. If on a convenient heading, the teardrop entry may be used.

In the example (Figure 1), the aircraft heading at the fix is 060 degrees and the inbound holding course (standard holding pattern) is 090 degrees. The inbound holding pattern course is within the 70-degree zone, therefore, turn right to parallel the inbound course. ★



NOTE

Reference IPIS Approach, January issue. The lost communications procedure on which the POINT TO PONDER was based, has been changed. Check the Revised Lost Communications Procedures in FLIP Planning, Section II, FLIP Enroute Supplement, or FAR 91.127.



HOW FAR IS UP?

Major T. J. Slaybaugh, Hq USAFE, APO New York 09633

A flight of three jet fighters recently accomplished three low approaches to a field that had a 4000 foot ceiling. They never became contact! During their letdowns the recommended altitudes were relayed to the flight leader by the PPI controller. (PPI approach equipment does not incorporate elevation indicators.) On one approach the controller instructed the flight leader to descend to 800 feet and vectored the flight right over the field. The flight leader acknowledged but still never broke out of the solid soup. Following the third attempt, all three pilots abandoned their aircraft because of fuel shortage. Three minutes later another flight of three broke out VFR at 4200 feet after a similar PPI run.

Investigation definitely established that the leader of the first flight misread his altimeter by 10,000 feet and never descended below 10,800 feet.

What you have just read was copied, verbatim, from the December, 1954, issue of FLYING SAFETY.

Now, here's a little gem. During a routine navigation flight, a T-33 pilot with passenger arrived at his destination, a midwestern field, and was cleared for penetration. Reported weather was slightly above published minimums and our pilot started down from what he thought was 27,000 feet. GCA had been contacted and two unsuccessful runs were made. During both attempts GCA had had no target on the precision scope. Now our boy tried a TVOR approach with radar assist. This, too, was no good. Somewhat desperate by now, the T-33 was flown to the nearby municipal airport and an ILAS approach was tried. Again foiled, the pilot climbed to what he thought was 7000 feet and he and his passenger used the next-of-kin switch and a nylon letdown. As you can suppose there was no fuel left for a try at the alternate.

A review of the taped transcript between T-Bird and radar control revealed that the pilot reported he was at 700 feet indicated during one point of the landing attempts. Since this was about 124 feet below the ground elevation at the military base and 300 feet below the ground elevation of the municipal airport, it was apparent to the accident board that our boy was misreading the altimeter. (The pilot stated later that he thought he must have been in a valley!) According to the pilot and passenger it took them about 10 minutes to descend from "7000 feet" in their parachutes. About 17,000 feet would be more like it for this time interval. Small wonder that the precision scopes never picked up the target. This pilot had never at any time come much closer than 10,000 feet to the ground. Rather hard to break a minimum ceiling from that altitude.

This accident account is reprinted from the September, 1959, issue of FLYING SAFETY.

Let's jump now to mid 1965. With weather partial obscuration, measured 1400 overcast, one mile in rain and fog, two pilots in a T-Bird made six successive GCA approaches and two PPI approaches, to altitudes as low as 300 feet in an effort to land at an island base. At no time did they see water or ground. No one on the ground heard the aircraft during any approach, although it should have passed over the field at very low altitude on several approaches. Precision approach units at the base of intended landing and at a nearby base were unable to obtain radar

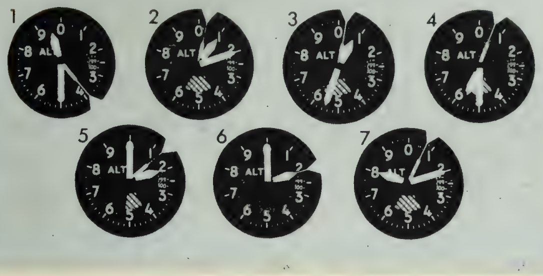
CAUTION

It is possible to set a majority of the standard altimeters with a 10,000-foot error by continuously rotating the barometric scale until it disappears, then again reappears. When setting the altimeter make certain that the 10,000-foot hand is reading correctly. ★

(Taken from AFM 51-37, Instrument Flying, page 4-4.)

contact. ASR contact was lost at two miles on all five approaches.

Can you read these altimeter settings accurately in one minute? Pilots should be able to. Try yourself and see, then check to see if you missed any.



Later, to verify that the pilots had made their approaches 10,000 feet too high, approaches were flown at 10,000 feet in another aircraft. Ground speed, as computed on the T-Bird, was found to be 150 knots, (120 knots IAS at 10,000 feet being approximately 150 knots TAS). When the check aircraft was flown at 10,000 feet ASR contact was lost at two miles.

Obviously, in 1954, we knew we had an altimeter problem. Just as obviously, we had it in 1959 and we still have it in 1965.

Let's quote more from the 1954 article, *because it is pertinent today.*

Inspection of the altimeter will readily show that at certain altitudes the 10,000-foot indicator is completely covered by the 1000-foot needle. Even with the needle not covered, it is small and hard to see, especially at night.

Although the 10,000 indicator is the big problem child, there are many recorded incidents where errors of 1000 feet jump into the picture.

Wright Air Development Center realizes the problem and is currently developing and testing new instruments designed to give a clearer presentation of altitude. But, until a new one is developed, we have to live with the hard-to-see altimeter with the hide-and-seek 10,000-foot needle.

And, as readers who pilot Air Force airplanes know, most of us still have to fly with this altimeter. They've added the barber pole hatch marks that begin to appear at 16,000 feet and are completely visible at all altitudes below 10,000 feet; also, the longer 10,000 foot needle with the inverted triangle at the end. This may have helped in some cases, but obviously didn't in the case of the eight-passes-then-punch T-Bird jocks.

But, if altimeter misreading can be condoned, this duo erred the right way. They read it lower than they actually were. Those who have read it higher than they actually were are dead, or, at least, scared almost to death. A case in point.

Four jets were making a night, IFR, beacon approach. Procedure turn was to be performed at 11,000 feet. The flight reported procedure turn, and, upon turning inbound, suddenly broke out of the overcast with their airscoops just clearing the tree tops. Yes, they were at 1000 feet, not 11,000. Another case of misreading the altimeter by 10,000 feet.

Accident and incident files record many such cases. How many more have gone unreported because of monitoring copilots, navigators and wingmen? And there's just plain luck — breaking out above forecast ceilings, between two hills, over lighted areas.

After the most recent fiasco, the T-Bird project officer at Norton did some research on the problem and came up with the following:

An F-100 became airborne under IFR conditions before the pilot recognized his altimeter was 10,000 feet in error with proper station pressure setting. Subsequent investigation determined there had been complete rotation of the setting dial prior to flight, resulting in a 10,000 foot error with the proper station pressure setting.

A B-47 on an assigned operational mission was scheduled to rendezvous with a KC-97 for air refueling. Visual letdown and contact with the KC-97 were accomplished and upon completion of air refueling, climb back up to 30,000 feet was made. Upon reaching this flight level (30,000) the aircraft commander reduced power and the aircraft was leveled off. At this time the instructor pilot occupying the rear seat noted his altimeter reading 20,000 feet. A cross-check of the pilot's, co-pilot's, and navigator's altimeters disclosed that the aircraft commander's altimeter read 10,000 feet higher than the other two. The mission was completed using the co-pilot's altimeter without further incident. Investigation revealed no previous altimeter maintenance. Position knob must have been rotated by unknown persons on the ground prior to flight and not noticed by flight crew during preflight.

A B-47 accident occurred during VOR letdown. The aircraft struck the terrain at approximately 4200 feet MSL. Most probable cause, misinterpretation of altimeter reading on part of crewmembers.

Transport pilot's statement "As I scanned my instruments prior to starting engines, I noted my altimeter approximately 500, low or high. On closer inspection I noticed the hatch marks to be out of sight and the 10,000 foot marker at the bottom of the case, on the figure 5. The resulting altitude was 50,860 feet. The Kollsman window was at approximately the correct setting. I had flown this aircraft as pilot the day before and the instrument was correct. There were no flights between the above-mentioned flight and the one we were starting. To set this instrument so far in error was not accidental. It took hard, deliberate effort. It took two pilots 10-15 minutes to put the instrument back to field elevation. Possibly you have some idiot who considers himself a practical joker, but I feel this was a deliberate effort at sabotage. (Pilot's instrument only one tampered with.)"

Here are a few more, very briefly, to show that virtually no pilot using the ancient, three-handed dial altimeter is immune:

A B-50 pilot was unknowingly a thousand feet or more lower at the time of turn to base leg than prescribed traffic pattern altitude and upon beginning a standard descent struck the ground.

A B-47 pilot misread his altimeter by 1000 feet. The aircraft contacted the ground 11 miles from the runway, then pulled up and landed on the base.

An F-89 pilot crashed into a ship 2¾ miles from the field.

An F-86 pilot misinterpreted his altimeter during descent and struck the ground.

An F-101 pilot struck the ground 1300 feet below assigned altitude.

An F-86 crashed during penetration turn.

An F-84 pilot misset his altimeter, then crashed at night, in heavy rain, when 900 feet low on final.

An F-102 crashed 10 miles short of the runway during a night approach when pilot misinterpreted his altimeter.

(Ed. note: In many of the above, as well as other similar accidents, the accident cause reported by the investigation board is undetermined, with misreading of the altimeters listed as "most probable." It must be so, interrogation of deceased being impossible.)

There are many more cases, but this sampling should, by now, convince any doubters that better altitude information must be provided if accidents from this cause are to be prevented. The cross-hatched-below-16,000 feet window and the longer, inverted triangle 10,000-foot pointer may have helped some, but these mods haven't provided a safe solution. Starting in 1966 the Air Force is slated to receive its first batch of counter-drum-pointer altimeters (see article on page 13). Initial installation is in production T-38's.

Pilots need no introduction to the instrument shown here. For a picture of things to come, take a look at the one pictured and discussed in the article on the next page.

In the meantime, for what limited good it might do, let's review some of the recommendations made by investigators through the years.

RECOMMENDATIONS

That copilots, navigators and radar observers monitor clearances and altitudes and advise the pilot of deviations.

That pilots brief their crews on intended approaches and minimum altitudes.

Proper cross-checking of altimeters is important.

That radar operators be suspicious when targets fail to appear and ask the pilot to double check his altitude.

Use the radio altimeter (whenever available) as a supporting instrument to the pressure altimeter.

During marginal or deteriorating weather conditions, go to an alternate, particularly if the flight isn't going as smoothly as it should.

Establish initial GCA level off altitudes in excess of 1000 feet above terrain in case the pilot should misread his altimeter by 1000 feet.

Require all crewmembers to read and report altimeter readings to prevent possibility of error on the AC's part, as well as malfunctioning altimeters.

Establish standardized procedures for use of the radar altimeter.

Development of a direct reading altimeter.

Properly set altimeters, and question any setting markedly different from the forecast setting.

Make ILS or GCA approaches whenever available.

SUMMARY

There are some well known deficiencies with the altimeters we presently try to fly by.

Misinterpretation due to the complexity of presentation is certainly one. One researcher who has long fought for a better altimeter is convinced that, had we been able to fly over 100,000 feet in recent years our present altimeter would have been further complicated with a fourth needle.

Another deficiency is the lag inherent in the standard Air Force three point altimeter. This deprives the pilot of precise information during some critical portions of flight.

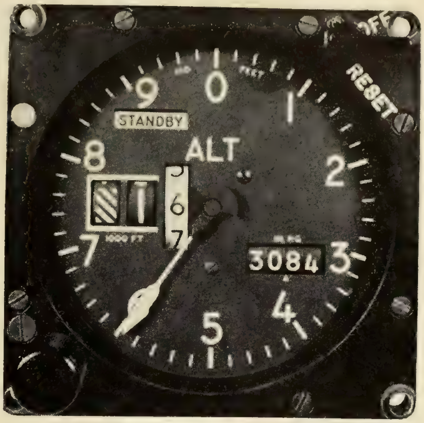
Icing of static ports, water freezing in static lines and tape left on static ports after aircraft are removed from the wash rack can also cause erroneous readings.

And there is the design deficiency that permits pre-setting so that a reading erroneous by 10,000 feet can be set. Some altimeters now have stops to prevent this (reportedly, years ago, it was learned that a drop of solder would be an effective fix.) Some background on this is in order.

During 1959 the Directorate of Aerospace Safety attempted to bring about installation of stops in altimeter setting mechanisms to prevent missetting with resultant 10,000 foot error in either direction. This feature was not adopted until early 1964 when new instruments were furnished with stops installed. Corrective action in the interim was issuance of safety of flight supplements in all flight handbooks calling attention to the hazard. There are many altimeters in the inventory which do not have stops installed.

Finally, remember these faults of our standard altimeter and benefit from experiences such as recounted in this article. History shows that so long as we try to fly using this instrument we will have accidents because of it. Finally (page 13) it appears that the Air Force Pilot is slated to receive a better altimeter. Don't relax. You don't have it yet.

Counter Drum Pointer



Early in 1966 the Air Force is slated to receive the first of the new AIMS Altimeter Systems, a sophisticated, computer-operated device featuring a counter-drum-pointer (CDP) cockpit presentation. First installations will be made in production T-38 aircraft with subsequent retrofit scheduled for other high and medium performance aircraft.

The system meets requirements of the AIMS altitude reporting program, which requires greater accuracy and transducers capable of furnishing an encoded signal to the aircraft transponder equipment. Availability of the encoded signal enables ARTC to interrogate any aircraft and get its altitude automatically and instantly. The AIMS accuracy objectives are ± 250 feet for all speeds and altitudes.

Aside from the familiar circular scale and X100 pointer, the CDP presentation differs somewhat in appearance from the present three-pointer altimeter. Starting at the left of the instrument (see illustration) and reading from left to right there are two counter windows and one drum window (white). The numerals presented in the counter windows indicate 10,000's and 1000's of feet, respectively. The drum window numerals always follow the pointer number, thereby indicating 100's of feet. The redundancy between pointer and drum window indications was incorporated to provide the pilot with altitude trend information that he has been accustomed to reading on the present three pointer altimeter. As a result, the altitude may be read directly by referring only to numerals displayed in the windows, or, by observing the counter windows and the pointer position.

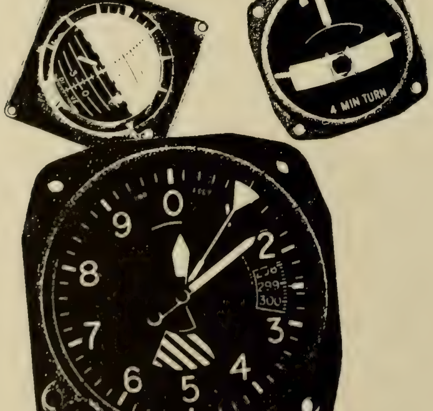
The new altimeter is driven servo-pneumatically. In the event of electrical circuit malfunction it automatically goes into STANDBY mode of operation. In the STANDBY mode, the altimeter reverts to strict aneroid operation and continues to display altitude to the pilot with the same degree of reliability and accuracy as the present non-servoed altimeter; however, in the STANDBY mode, altitude information is no longer transmitted automatically to the ARTC. The pilot is alerted to this condition by the appearance of a red STANDBY flag that appears on the altimeter face. A switch is provided on the altimeter that enables the pilot to attempt to return the instrument to its normal mode of operation. This switch may also be used to manually place the instrument in the STANDBY mode of operation, when and if the pilot has reason to satisfy himself that the unit is operating properly.

Experienced Air Force, Navy, and Army pilots compared this altimeter to other displays during an extensive flight evaluation exercise. They overwhelmingly preferred the counter-drum-pointer as the best choice. In addition, pilots of the Instrument Pilot Instructor School (IPIS) and the Directorate of Aerospace Safety who flew with the CDP altimeter agreed that it is a significant improvement over the standard three-pointer display. Comments ranged from "very good" to "the best altimeter I have used and undoubtedly the easiest to learn to use." Perhaps the biggest improvement the CDP offers is that the completely digitized display requires no interpretation, just observation.

During the flight evaluation, several design deficiencies were discovered in the laboratory models of this altimeter. Discrepancies included a tendency to "hang-up" and whip in STANDBY mode, partial concealment of the counter-drum information due to the shape and size of the pointer, slow counter movement in the 1000-foot change point, and possible confusion due to similarity of number presentation of the counters and drum. Corrections have been made (some of the changes are visible in the illustration above and production models will contain these improvements).

In summation, the new altimeter design promises to provide a decrease in probability of misinterpretation, greater accuracy, less lag in altitude presentation, and eliminates the possibility of presetting the 10,000-foot error when adjusting the baroset. All of these improvements to this most basic of instruments are vitally important to upgrading flight safety. ★

INSTRUMEN

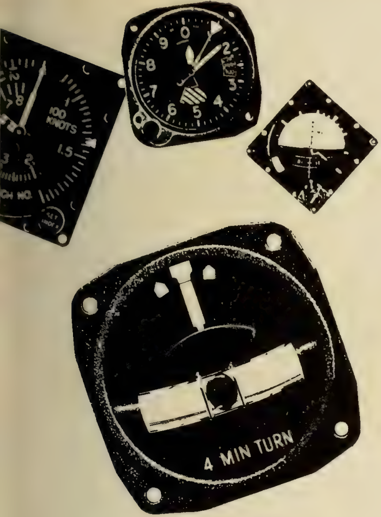


LOOSE PARTS IN CASE

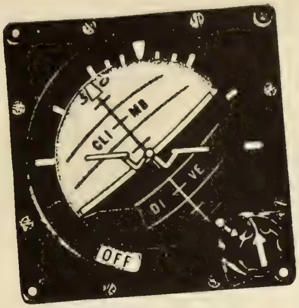
INSTRUMENT TROUBLE. Once in a while ol' Rex gets pretty hot under the collar. In fact, if . . . but first let me tell you what happened to get Rex this way. First off, a couple of weeks ago one of the troops was gripin' about having had to make an approach at near minimums with an attitude indicator that was practically worthless. Said this was the third time in the past month that he'd had instrument trouble.

So Rex inquired around and found that almost everybody in the outfit had a similar complaint. That did it — Rex went down to the shop and asked a few questions. The notes he took weren't encouraging. He then compared write-ups in the Form 781A and reviewed the 66-1 data. Here's just a bit of what he found:

- Five gyros received from Supply were found to be defective during bench check.
- Another five indicators had to be removed from fighters because of pitch oscillations, tumbling, slow erection.
- Attitude indicator jumps up and down five degrees in pitch — defective gyro. Overhauled by . . .
- A pilot write-up mentioned an attitude direction



FAILED BENCH CHECK



PITCH OSCILLATIONS

PARTS MISSING

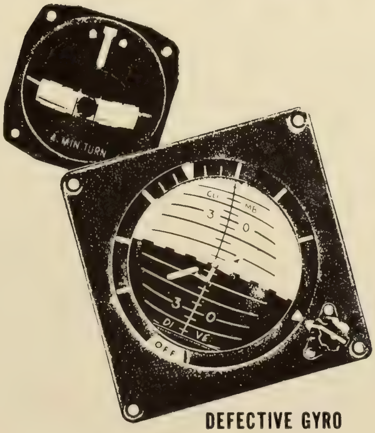
TROUBLE !

indicator (ADI) that would not indicate less than 35 degrees of pitch. Defective gyro.

- On first flight after installation, OFF flag flickered and indicator showed 90-degree bank and 20-degree climb.
- Within past two months 22 vertical gyros received from Supply had numerous discrepancies that could not be repaired at field level.
- Over a period of time, two hundred and ninety-nine — **that's 299** — airspeed indicators received with parts missing. Overhauled at . . .

Well, that's enough. Does this seem compatible with what we've been teaching pilots for years —"*trust your instruments.*"

All this made Rex so mad that he's been thinking seriously of gathering up a pile of this junk. Then he'd fly it to the overhaul facilities and present the facts. Maybe then, with the evidence at hand, the overhaul facilities would revert to 100 per cent quality control of the essential flight instruments. *Then* we could continue to teach our successors to "believe your instruments; they are reliable." ★



DEFECTIVE GYRO

GRASS CLIPPINGS

Capt John F. DuPriest, SMAMA, McClellan AFB, Calif

I have a neighbor who's an out and out square. He never gets nagged at, cussed out, or exiled to the sofa. He works five days a week exactly from eight to five. He has never in his life forgotten to mail a letter, nor has he ever forgotten to remember an anniversary. He has never been broke six days before pay day and has never run out of gas on the freeway. His car always looks like he just washed it, and worst of all — the absolute cap on the stack —

HIS LAWN NEVER NEEDS MOWING!!

Oh, his grass grows just like mine, but the difference in his velvet carpet and my shag rug is MAÑANA. Or, as they say in Old Mexico—THE ART OF DELAYED ACCOMPLISHMENT. Or, as the Dan Webster says — PROCRASTINATION — to delay, to postpone, waste time.

Every Saturday at precisely 1259 hours, my neighbor fires up his rotary rock slinger, carefully letting it warm up for one full minute. (He read that in FAMILY WEEKLY.) At precisely 1300 hours, he moves the snarling machine briskly forward and spews forth the first clippings, none of which will measure over ONE-QUARTER INCH LONG.

One of those particular Saturday afternoons I'm glued to the old TV 'cause Jim Piersall has one leg over the fence on his way to murder a wiseguy in the bleachers. And it happens — "Elwood's mowing his lawn." (Of course the initial decibel level is always low down in the hint range.) Piersall is now vaulting the second row. "ELWOOD IS MOWING HIS LAWN!!!" (Up 200 dbs.)

"Huh? What's that?" Course you KNOW what it is; it's Delovely with fist on hips.

"I said," (down 150 dbs into the holier-than-thou range) "Elwood is mowing his lawn. Don't you think you've waited long enough?"

Now Delovely doesn't REALLY care about a short green carpet out front but a tricycle is lost somewhere between the front porch and the curb and the kid is really buggin' her about it. So I trudge out before Piersall gets to the ninth row.

And after the deed is done (my long green lawn is now short yellow stubble; that'll show her) good old Elwood is bending my ear on how we should have handled the Cuban situation. And then, with absolutely no provocation, he does it: "You know what's wrong with you, John, old boy?" On such short notice the best I could do was, "No, what?"

"You're a Procrastinator!" he said, derogatorily. "You put off mowing your lawn for three weeks and you KNEW it was inevitable. That grass surely can't grow shorter. You just procrastinate, that's all," he droned on, monotonously. "Tell me, John, old boy," (I'll old boy you in a minute, you . . .), "tell me, do you procrastinate pulling up when you put your airship in a dive?" (I knew it; he's got every Tom Swift book ever printed.)

Maybe it was my tightening lip or the look in my eye. At any rate, he canned it just before my decision to IRAN his impeccably straight nose. BUT as he disappeared into his hospital-clean garage, he twisted the knife once more. "Think it over John, old boy. If you don't believe me, just compare our grass clippings."

Compare our grass clippings! He not only has a sterile garage, his brain is sterile too.

Grass clippings! GRASS clippings!

Boy! Elwood, you really are loose in the flue. Those clippings aren't long. There's not a one over an inch and a half long. Course that mower mulches it up pretty well. What the heck, I can prove it. I'll just measure the distance from the sidewalk up to the handle bars of the trike. Now let's see — it measures SEVENTEEN AND FIVE-EIGHTS INCHES!!

Now, that can't be right. Delovely didn't have her glasses on when she was hunting the trike, that's all. (Course *I* was the one who finally located it, and THEN only after the second mow-around.)

You don't suppose . . . naw, can't let old coghead next door get to me.

Back at the game Pee Wee was summing up the statistics with no mention of the mayhem that must have occurred in the center field bleachers. And the first commercial comes on. "DON'T DELAY! DON'T WAIT! DO IT NOW! NOW FOR THE MOST FANTABULOUS DEAL OF YOUR LIFE! DON'T WAIT! DO IT NOW!"

"Yes," I mumble under my breath, "or your grass clippings will measure SEVENTEEN AND FIVE-EIGHTS INCHES."

I AM cracking! I got even. I jumped up and turned off the TV much harder than I usually do.

Enter number two daughter. "Daddy, what does this mean — 'he who hesitates is lost,' huh, Daddy?" Lucky she should come to an old authority like me.

"Well, honey, that means that if you fiddle around or delay doing what you SHOULD be doing, you'll miss the boat." (Typical authoritative analysis.)

"Well, Daddy, what does THAT mean?" (This kid MUST take after her mother.) "Honey, climb up on my lap and Daddy will tell you a (war) story and that will show you what I mean," I said in a fatherly tone.

"One day not long ago, I had to make a rum-run, er, ah — an administrative flight to El Paso. Dad had to get up real early to get out to the base and plan his trip. Well, the alarm clock went off that morning, but daddy thought he would just wait 30 more minutes before he got up. And he fell asleep and didn't get up for an hour and fifteen minutes more.

"Now, Daddy had to run real fast to get his airplane ready to fly and he only had time to read the NOTAMS for El Paso and NOT for the points in between. What? Oh, Notams are things like notes from the principal. But anyway we took off and everything was peachy until we tried to tune in a little town called Zuni. We couldn't get the radio station and Daddy got lost."

(Not a bit of sense in telling the kid about the Air Guard interceptors herding us out of Old Mexico.

And no use mentioning the reaming by the Old Man and his caustic remarks about delaying getting up until the last minute. I personally think it was dirty pool hiding a notice of temporary shutdown of Zuni Radio in as unlikely a spot as the NOTAMS.)

"So you see, honey, if Daddy had not put off getting up, he would have had time to read the note from the principal and he would have known that he could not fly over Zuni."

The poor kid walked away looking kinda blank. Maybe the one about the time I waited too long to break off an air to air gunnery pass and swallowed 21 feet of target cloth would have been easier to understand. Course, at the time it was darned hard for ME to understand.

Or maybe the one about the time I tried to stretch the glide in that T-Bird at Willie and donated three gear to the junk dealer. (The Board said, "Pilot error in that the pilot delayed too long in applying power to avoid landing short.")

DELAYED . . . FIDDLED . . . WAITED . . . PROCRASTINATION . . .

And there was that time when I drove by the dispensary and for no reason at all just decided to wait and get those shots later. As I recall, the annual records check got the same identical treatment.

Just a bad habit I'm going to break one of these days. (A true procrastinationist even delays to start to break the habit.)

The day I almost punched out of a T-Bird was a result of waiting — waiting for a rainy day stand-down to bone up on the Dash One.

High grass and dirty cars aren't too serious. They are social items that can only result in dirty looks from the neighbors and lost tricycles. But this postponing studying emergency procedures and sacrificing flight planning for an extra forty winks can flat get you KILLED.

So to put a stopper on a story, all this got me to thinking: MAYBE WE'RE NOT COMPLACENT AT ALL. MAYBE WE JUST DELAY FACING REALITY. MAYBE WE JUST DELAY BONING UP. MAYBE WE PROCRASTINATE OURSELVES TO THE LIP OF THE GRAVE.

So I long ago decided to try to kick the habit. And it isn't easy. There are all sorts of things working against me. Baseball versus mowing; good gunnery scores versus an almost-out-of-range break-off; and a good James Bond novel versus the Dash One.

But I must be making a slight headway, 'cause it seems like I'm being nagged at less and enjoying it more. I'm getting along with Delovely and the C. O.

And I even get along fairly well with Brick Brain next door. He has matured a great deal. The remarkable thing is that he's not half as square as he was in the days *before* I got my smooth green velvet lawn. ★

The trip had been one long series of frustrations — he'd been stuck here for five days waiting for a part that never arrived. He'd made a fix of his own, not by the book, maybe, but it worked. Now he was ready to go.

"Lucky 64, tower, standby for clearance in one minute."

"Six four." Finally; now if they'd just hurry a little he could get going. Boy, did he have a pile of things waiting for him at home!

"Four-two-niner, this is the aircraft behind you. You appear to have fuel leaking out of your right external tank."

"Rog, thanks." He thought it over for a moment, decided it wasn't anything serious.

Two minutes later Air Force 8429, Flight Lucky 64, was cleared and rolling toward a junkyard 500 miles away.

Destination was 1850 miles southeast of here but there was to be an intermediate stop for fuel a bit over 1000 miles east. Takeoff was uneventful; as he climbed to cruise altitude the aircraft seemed to be behaving in acceptable fashion. If it continued to do so he might make it home in time for a home-cooked meal, his first in a week.

For the first hour the flight was uneventful, except for the center advising him that he was quite a bit off course (50 miles) shortly after he'd made a turn to a new heading. They'd given him vectors to get him back on course. Another half hour had elapsed before he noticed that his fuel wasn't feeding correctly. He calculated for a few minutes, then cursing softly, faced reality and admitted that he couldn't make it. Better get 'er on the ground at the nearest base. That would be Salem.

". . . Center, Lucky 64, I've got some kind of fuel trouble, will you vector me to Salem Air Force Base immediately?"

"Lucky 64, standby . . . Okay, 64, you are cleared to Salem Air Force Base. Turn right heading one niner zero, maintain flight level three one zero."

"Rog, one nine zero, three one zero." A moment later the controller gave him a distance of 98 miles to Salem. He did a little more figuring; he should be able to make it, but it was going to be close.

Twenty-nine minutes later Lucky 64 ran out of luck and the pilot was killed when he ejected too low to escape. The crash scene was 26 miles from the end of the runway. Witnesses said the aircraft was descending then pulled up suddenly and fell almost straight to the ground. About a second before impact the pilot ejected but the parachute didn't open. The first men on the scene found Lucky 64's pilot still in the seat.

Their first look at the wreckage convinced the accident investigation board that their work was cut out for them. Although the wreckage wasn't scattered over a very wide area, it was well broken up. Considerable fire damage was evident. There was one clue — the pilot had changed his destination because of a fuel problem. After requesting vectors to Salem he had advised the center as to the amount of fuel remaining in flying time. Although, it was close, the pilot evidently thought he had enough fuel to make it. He had not declared an emergency. He had, however, asked for lower altitudes several times and indicated that he would descend at idle power to conserve fuel. There was also a

Lack of parts, jerry-rigging maintenance, impatience . . . these stole the luck of . . .

lucky 64

paradox in that the wreckage gave indications of a fuel-fed fire.

By the time all the material was assembled a picture began to be formed. Some of the lines were hazy but as the investigators sifted the evidence they began to come into focus. The picture told a story: mechanical difficulties, a pilot away from home base for more than a week on a flight that was to have taken only four days; exasperation on the pilot's part because he couldn't get the aircraft repaired quickly, finally performing unauthorized modifications in order to get the engine started. Then, his problems apparently solved and expecting clearance momentarily, he'd been told of a fuel leak. Who knows? At any other time he may have taxied back to find out the cause. But this time he didn't. Gethomeitis? Who has a better answer?

Then over an hour of uneventful flight followed by the rueful decision to change his destination because of fuel trouble. Center had queried him as to the nature of the trouble, but the only reply was "fuel."

To the investigators it was obvious that there had been a great deal of fuel aboard when the aircraft crashed; they estimated between 3000 and 4000 pounds. What, then, had been the problem? Why had the pilot declared fuel trouble and diverted from his flight plan to another base?

Lucky 64 was one of three fighters that took off on a cross-country training mission nine days prior to this accident. During the last portion of this flight, Lucky 64 apparently was flying with an inoperative main boost pump. This plus the fact that he could not get the aircraft started caused Lucky 64 to remain behind when the other two aircraft took off on the return flight.

For the next five days the pilot worked on the aircraft himself (he was not at an Air Force base). Meanwhile arrangements had been made for necessary parts to be flown in to repair the aircraft. However, on the morning of the ill-fated flight the pilot called his home base and cancelled the parts order saying the aircraft was now in commission.

His "fix" consisted of altering the starter system. This enabled the engine to be started.

After determining that the engine would start, the pilot had breakfast, then filed for the first leg of the trip home. It was while waiting for takeoff that another pilot spotted fuel leaking from the right external tank and advised the pilot of this fact.

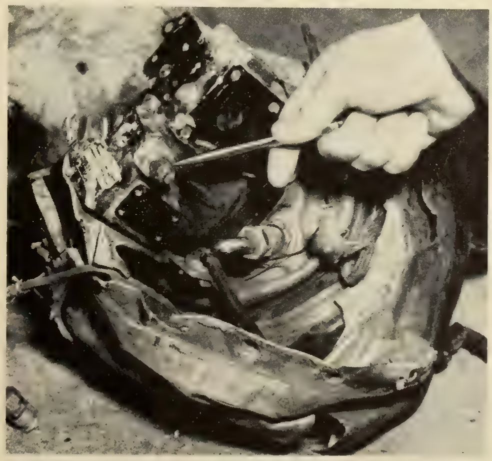
Everything after this until he became concerned about fuel, more than an hour after takeoff, apparently appeared normal to this pilot. However, his flight planning indicated that he was in a hurry— there were several discrepancies. Then he got off course nearly 50 miles and was directed back to course, a heading he was flying at the time he became alarmed about his fuel state. The fact that he was several minutes ahead of plan indicated either stronger winds than anticipated or careless flight planning.

After requesting vectors to the alternate base the pilot told the center that he had fuel for about 25 minutes flying time. The crash occurred 29 minutes later. Witnesses stated that during the last few seconds of flight the aircraft was "flipping back and forth" or "weaving from side to side." Just before the crash the aircraft pulled up into a sharp, nose high attitude — possibly for an ejection attempt — then nosed down and hit the ground.

The primary cause of this accident was attributed to poor fuel management on the part of the pilot. The contributing causes reinforced this determination: The pilot took off with the main fuel tank booster pump inoperative — a red cross condition; he took off knowing an external tank was leaking; he was unable to transfer fuel because of malfunction in the fuel system from an unknown cause.

Add to this another possible contributing factor: There was no supervision — this pilot was strictly on his own despite the fact that the aircraft had several things wrong with it, including one safety of flight item, and the aircraft was not on an Air Force base.

This tragedy occurred to one pilot in one fighter aircraft. The crash was in a fairly remote spot where there was no hazard to lives and property on the ground. Therefore it received little, if any, publicity. Nevertheless, it is a classic case of what can happen when gethomeitis and lack of supervision conspire to take their toll. ★



Get-home-itis and impatience, finally a do-it-yourself mod job to get engine started ended pilot's career. Investigator points to jerry-rigging repair job.

Missilanea

AGM-28 DOWNLOADING—An AGM-28 missile was being downloaded and the H2-33-A positioning trailer was towed under the right wing of the B-52. The trailer was disconnected from the tug. As the tug proceeded from under the missile on the outboard side, its arm rest came into contact with the engine, damaging the leading edge of the inlet diffuser. The diffuser had to be removed and returned to the depot for repair.

The primary cause of the mishap was improper judgment of clearance by the tug driver. As a result, the following maintenance practices are being placed in effect at the unit concerned:

- Disconnect the trailer from towing vehicle forward of the missile.
- Towing vehicle will not be operated, parked, or positioned under any portion of the missile — at any time.

Good procedures! Lets all exercise care around missiles and aircraft and cut out these careless mishaps.

Maj Edwin D. Jenkins
Directorate of Aerospace Safety

FALLEN FALCONS—A driver was attempting to exchange tractors in preparation for towing a flatbed loaded with AIM-4A and AIM-4C (Falcon) missiles. Prior to disconnecting the tractor from the flatbed the diver cranked the jackpad down on the right side, but neglected to crank the left jackpad down. When he drove the tractor from under the flatbed, the flatbed tipped, allowing five of the missiles to slide to the ground. The missiles were sent to the depot for damage assessment and repair.

The flatbed was a new type requiring each jackpad be lowered individually, whereas the flatbeds the driver had previously used were equipped so that one crank lowered both jackpads. Tractor drivers have been rebriefed to visually insure that trailer jack pads are lowered before removing the tractor. In addition, flatbeds having jackpads requiring individual operation will be so marked.

Personnel error in the ground handling (loading and transportation) of AIM-4 missiles continues to be the primary cause of mishaps, accounting for over 60 per cent of Falcons damaged.

Capt. R. A. Boese
Directorate of Aerospace Safety

ARM! DISARM! Most missiles now emplaced have two configurations of arm-disarm switches, styles A and B. *Each configuration requires a different technique for removing the safing pins.* Failure to recognize this difference may lead to jamming of the style B switch and possible aborted missile launches.

Style A is used on the stage separation system of missiles initially installed in the first four Minuteman Wings to become operational; style B is used on the third-stage thrust termination system. Subsequent missile changes incorporate the style B switch for both stage separation and thrust termination purposes on Wing V missiles.

To remove the safing pin in the style B switch, first, engage the special wrench per T.O. 21M-LGM30A-2-10; second, carefully but firmly push the safing pin straight into the missile until a definite stop is reached; third, release the pressure on the safing pin slowly counterclockwise until a stop is reached; and fifth, pull safing pin straight out.

To remove the safing pin in the style A switch, the procedure is the same as that for style B except after depressing the pin into the missile, the pin in its depressed position is rotated counterclockwise until a stop is reached. Thus, step three for style B as noted above is eliminated for style A.

Emphasizing this difference in procedures another way, the safing pins in style A arm-disarm switches are removed by depressing and then turning counterclockwise whereas in style B switches the pins must be permitted to back-off after depressing and before turning.

Boeing Minuteman Service News

The Fable of the Ogre

Lt Col Reuben B. Moody, Vandenberg AFB, Calif

Once upon a time there lived an ogre. He earned his livelihood by functioning as a missile safety specialist for a ballistic missile squadron. The ogre was not pleasant to behold and his manners were fierce. His eyes were beady and usually bloodshot. On his arms there were many stripes. His voice grated on the ear. When in an evil temper, which was usually the case, he seemed to move about in an aura of fire and brimstone. It was rumored that, on the occasions when his ire was extremely aroused, lightning bolts had actually been seen to flash from his glittering eyes.

There also worked in the squadron many technicians who administered to the divers machines and devices of the place. The technicians feared, detested and thoroughly loathed the ogre, for it seemed to be his pleasure to continually harangue and harass them in the performance of their duties. Hard hats must be worn in certain areas. Protective clothing must be donned when doing certain tasks. Checklists must be strictly observed. Safety inspections must be accomplished. These, and many others, were the dictates of the ogre and woe to the technician who violated them.

There was much muttering and gnashing of teeth among the technicians. Always they were badgered, plagued and tormented by the ogre. No area within the complex was exempt from his probing and his gimlet eye. Nothing escaped him, and those technicians who disobeyed his edicts were lashed by his tongue and his words were caustic. Beyond the ogre's hearing, the technicians were profane in their references to him and many slanderous remarks were made regarding his possible ancestry. But their mutterings were in vain for the ogre was the chosen of, and protected by, the Commander.

The ogre persevered and increased in his unpleasing ways. His zeal was such and his fits of rage became so frequent that, eventually, he was stricken by the ulcer. This caused his humor to become even more outrageous. But, with the coming of his single ulcer, the ogre fell into disgrace. It was well known the ogre's job required the development of at least two ulcers. He was therefore banished to the hospital and sentenced to a diet of milk and crackers. This was indeed a terrible fate, for the ogre's favorite diet had been to chew on errant technicians.

When the ogre began his exile, there was much rejoicing among the technicians. They were exceedingly glad and they relaxed from the rigorous disciplines which had been imposed by the hated ogre. And lo! The technicians, in the midst of their rejoicing, were visited by a plague of accidents and incidents. A skull was cracked for want of a hard hat. Unconsciousness came to a technician who carelessly breathed of toxic vapors. A fall occurred and a bone was fractured for want of a protective railing. Finally, and most tragically, death claimed a technician when he inadvertently became part of an electric circuit.

The technicians became sorrowful and they had cause to reflect. Through their reflections, they came to realize that their ogre had been a good ogre. His hated edicts, his detested discipline, and his fiery ministrations had heretofore prevented the visitation of the accident-incident plague. They came to realize they had maligned the ogre and they were filled with regret. Collectively the technicians heaved a sigh and longed for the return of their ogre.

And it came to pass the ogre completed the term of his banishment and he was permitted to leave the hospital. From his exile, the ogre returned to the squadron, and there the technicians greeted him with open arms. Again there was much rejoicing and celebration. And they all lived happily together forever after. MORAL: HONOR THY OGRE. ★

"EYEBALLS" FOR THE TOWER

A large step forward tomorrow has been taken by SAC and AFCS in pioneering the technique of bright radar display in towers.

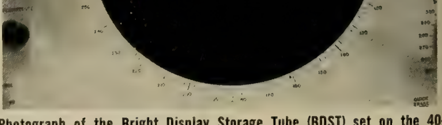
Lt Col Gifford M. Briggs, USAF-Ret.

How many times in your flying career have you just about completed a successful mission only ave your nerves shattered through an ulcer-producing near miss in the terminal area? We continually search our souls asking, "Why does this happen?" The air traffic controllers are trained to be diligent and prevent traffic conflicts and the pilot is continually reminded of his responsibility to see and avoid other traffic. The brutal fact is: Neither the controller nor the pilot can see many aircraft, particularly if they are operating at high speed in areas of reduced visibility.

There are other factors. For kicks, add in the guy that's VFR and just happens to wander into the control zone. Our advancement in civilization has also helped compound the problem through SMOG pollution of the atmosphere. Aircraft size is another consideration. Take any two people familiar with an aircraft, say the size of a B-52, and ask them to give you an estimate of distance out on final from touchdown. If you get identical answers, that's fine, but chances are the actual distance is missed by both. Add your smog, night conditions, speed, pop-up VFR traffic, and you come up with one enormous problem.

For many years, particularly since the development of the radar approach control concept for movement of aircraft, it has been recognized that the last 10 miles of the final approach are highly taxing to both the pilot and the air traffic controller's professional skill. Here we have IFR aircraft feeding into the approach sequence with VFR traffic, possibly compounded by an occasional aircraft without radios or with lost communications. To sequence this traffic requires the utmost of coordination between tower and RAPCON. Additionally, it behooves the pilot to put his neck into full swivel to see and avoid other traffic at a time when it is imperative that he concentrate on his landing approach. To feed you into the final, you either remain with RAPCON for full radar service or, if making an ILS run, your communications control is transferred to the tower controller. Chances are, at this point he cannot see you and must rely on only time/distance to integrate you successfully with his closed pattern VFR aircraft. The problems enumerated culminated one day several years ago with a most tragic midair collision of two B-52s.

The technology of aircraft design seems to place more emphasis on speed than visibility requirements. The ever-increasing civil fleet, together with new airports in close proximity, place demands on the human technique for applying regulations which are beyond



Photograph of the Bright Display Storage Tube (BDST) set on the 40-mile presentation with five mile range marks.

their capability. Recognizing this to be a fact, the solution then becomes one of advancing the technology of equipment designed to aid this human deficiency.

The combined efforts of SAC and AFCS have accomplished this by providing the tower controller with improved eyes, capable of detecting aircraft and judging the spacing between these aircraft more accurately. As you have guessed, this extension to the controller's eyes is in the form of Bright Display Storage Tube (BDST) for use in towers. This tube is an adaptation to basic radar and provides a display which can be viewed directly in all light conditions, whether it is a bright sunny day, dull, or dark. The display had to be bright enough so that no light adaptation factors entered into the picture. With these parameters and specifications, we set out to sell the idea to the electronics industry. The manufacturers came up with many suggestions, and attempts to develop this equipment, and, finally, the breakthrough came. After testing extensively at Castle and England Air Force bases, the results were as expected. Here at last was an "eyeball" extension for tower controllers. He not only can "see" farther, but also "see" directly into the sunlight, "see" through the haze, get an accurate fix on distances and perhaps most important of all, "see" the joker who just happens to wander into your flight path when you are at your busiest moment of flight.

This development for flying safety in the USAF is officially nomenclatured the GPA-118. Procurement schedule of the GPA-118 calls for 20 during FY 65, 30 during FY 66, and 30 during FY 67. Major air commands have already established base priorities through the traffic control and landing systems (TRACALS) program so, in the near future, you can expect to have this device for use in your terminal area. FAA is researching the BDST concept and a VIDICON pickup technique for tower bright display capability.

In summation, though, let us part with a word of caution. No matter how sophisticated we become please, for your sake and ours, don't relax your vigilance and responsibility to see and be seen. This cardinal rule for VFR weather operations must remain inviolate. ★

NO NUMBER 44

Lt Col Merle B. Nichols, Directorate of Aerospace Safety

During the month of June the Air Force experienced 43 major aircraft accidents. Here is an account of what could have been Number Forty-Four, but wasn't. Everyone involved (especially the pilot, who just by chance happened to be the safety officer) did everything just right! The original message tells the story as well as we could, so there has been only minor editing.

Approximately 10 minutes after level-off at 39,000 feet, the pilot of a T-33 felt an explosion in the aft section of the aircraft, accompanied by a loss of thrust, RPM and EGT. The gangstart system was immediately activated but RPM and EGT decayed rapidly to zero. After determining that further airstart attempts would be futile, the pilot turned off the gangstart switch, stopcocked the throttle and declared an emergency. He received an immediate vector toward Perrin AFB and a TF-102A was vectored into chase position. The T-33 pilot turned off all electrical equipment except UHF radio and set up a tech order glide. The chase pilot saw three holes in the bottom of the fuselage adjacent to the turbine wheel stripe but reported that there was no evident of fire or major aircraft damage.

As the T-Bird passed through 28,000 feet, the pilot determined that it would be impossible to glide to Perrin. He was given a vector to the Paris, Texas, civilian airport (Cox Field), 30 NM away, which has a 4500-foot runway. When he decided to attempt a flameout landing, the Paris police department was notified to dispatch a fire truck and ambulance to the airport, which was closed for the evening. Runway lights were turned on because of impending darkness.

During descent the canopy and windscreen frosted over, causing the pilot to divert his attention by having to scrape the canopy for adequate visibility. The T-33 arrived over Paris at 12,000 feet and began a 360-degree descending turn to high key. The TF-102, which descended to the runway to clear traffic, reported that the runway was clear and appeared adequate. The landing gear were lowered on final approach when the landing was assured. A smooth touchdown was made 300 feet from the approach end. The pilot used maximum braking and opened the canopy at 80 knots, but was unable to stop on the runway without blowing the tires. The aircraft stopped after rolling one foot into the unprepared overrun.

Damage to aircraft was limited to three holes in the bottom of the aft section, as a result of three turbine blades and two turbine wheel fir trees being thrown through the fuselage. Estimated manhours for repair came to 44 hours. The left main tire tread measured 1/16 inch at all four 90-degree points, and the right main tire tread measured ⅛ inch at all four 90-degree points. Both tires had even wear, with no flat spots. ★

At one base inspection disclosed 80 improper life raft installations. Someone just hadn't done his homework, which may account for the problem of . . .

LOST RAFTS

T. L. Gulliksen, Senior Design Engineer, Lockheed-Georgia Company

Most users of aircraft that have life rafts stowed in areas other than the pressurized compartment have, by this time, been made painfully aware of the hazardous aircraft control problems which can arise when a raft leaves its nesting place during flight and artfully drapes itself around a control surface. The "after-the-fact" corrective action of flying at reduced speed and lower altitude, hoping that the raft will remove itself from the aircraft, has worked quite well so far, but leaves a great deal to chance.

Since the C-130 first became operational, and reports of life raft losses started filtering back, Lockheed-Georgia Company, along with the services, has initiated numerous study programs and, in fact, incorporated some significant changes into the overall system. These modifications have been quite helpful in improving system reliability, however, space prohibits a lengthy discussion of them. Therefore I will discuss some current problems beginning with raft evacuation.

While conducting our life raft test this past winter, we tried to make a properly evacuated raft eject due to entrapped gas. We were not successful. To perform this test, a full size raft compartment was fabricated using production components. The raft, a Type F-2B, was inflated, vacuum pump evacuated, folded per applicable specification and placed in the compartment along with the accessories container and inflation components. The vent manifold was closed prior to latching the compartment door and the test article was placed in the altitude chamber. Pressure in the chamber was reduced to simulate 35,000 feet, temperature stabilized at minus 65 degrees. At this altitude the compartment door was observed to bulge approximately eighty thousandths of an inch in an area just forward of the latch. During the second cycle of this test, the compartment door was propped open so that raft expansion could be observed. The expansion amounted to approximately eight per cent of volume at 35,000 feet, not enough to force the door. The door was latched and the test cycle repeated with no change in results. From this test we must conclude that a properly evacuated raft will not leave the aircraft even if the vent manifold is not functioning. Of course, if the CO_2 cylinder valve develops a poppet leak, and the manifold is inoperative, the raft will be lost. This is another problem that we'll go into later.

Rafts installed in wing trailing edge compartment. Unvented gas pressures can build up enough to cause door to pop open, loss of raft.

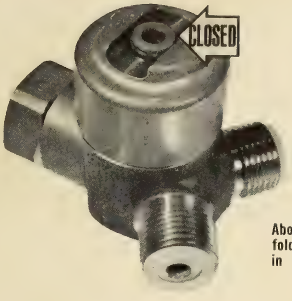
For good evacuation, a constant displacement vacuum pump must be used, not the vacuum cleaner. These pumps have to be maintained. We visited one facility that was using a pump on which the oil reservoir had been dry long enough to gather dust. The thing just cannot pump with a dry reservoir. At another base, the one approved pump had been broken for three months. A vacuum cleaner was being used. This base was reporting raft losses at an alarming rate. Of course, the new vent manifold should have taken care of the residual gas, that's what it was designed for. Why didn't it? According to one of the technicians assigned to raft installation, the question was simple; in his opinion, the manifold operating instructions were not correct and needed to be changed. After the approved pump was repaired and the people at this base started using the vent manifold as instructed, life raft losses became a rarity.

How about the CO_2 cylinder? Three reports were received in 1964 informing us of partial raft inflations during landing, taxi and takeoff. Entrapped gas does not expand at sea level. The aircraft on which these incidents occurred had flown several missions since installation of rafts, another fact which rules out gas entrapment. After receiving these reports, altitude tests were conducted on both makes of cylinder-valve assemblies in an attempt to find a leak path. Although neither assembly malfunctioned during the course of the test, a detailed inspection of one make of valve revealed possible leak paths through and around the poppet. Some slight grooving of the rubber could be seen. Continued high altitude use would, without doubt, increase this grooving until the poppet would not seat and a leak would develop. In addition, minute metal chips were discovered on the valve seat, compounding the grooving problem. To overcome this problem we suggest inspecting the cylinders and valve assemblies more often, and more thoroughly. There should be a maximum of three years between detailed valve inspections. Cylinder weight checks, discharge cable length checks and valve cam safety wire integrity inspections must be accomplished frequently. In our opinion, the existing collapsible cable housing should be replaced with one of a solid length design. Low pressure hydraulic hose would be ideal for the job. Of course, the most "Murphy" proof action would call for a new valve design which combines the raft inflation function with the cylinder-raft vent function.

What about this vent manifold? Why hasn't it put a stop to raft losses if it is correctly designed? The greatest weakness of this safety component lies in the fact that it can be misused. The manifold operates on a pressure differential concept; light pressure against the diaphragm will not overcome the o-ring detent and will be vented, but a pressure surge will close the vent, allowing the raft to fill. During our tests we cycled the vent manifold from ground level to 35,000 feet and down, time after time. Each time pressure in the chamber was increased to ground level, moisture laden air was introduced. After waiting for the moisture to accumulate around the vent opening, pressure was again reduced and the temperature adjusted to 65 degrees below zero. We wanted to cause a vent freezing malfunction. Enough moisture did accumulate at the vent opening to form ice, but we were never able to get the vent opening blocked.

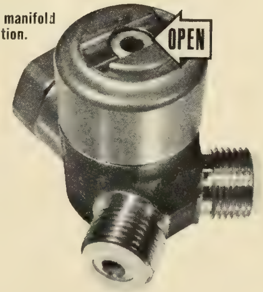
As a further vent function test, we inflated the raft with a cylinder and then deflated it by hand, forcing out as much gas as possible. An entrapped gas inspection was carried out in the altitude chamber and expansion was found to be approximately 30 per cent of volume. Somehow we stuffed this raft with all the overwater survival gear into our test compartment and closed the door after opening the vent. As pressure in the chamber was decreased, the door was observed to "breathe," first bulging and then relaxing. The vent manifold was obviously functioning. At 35,000 feet the door bulge was one tenth of an inch. Had all the gas been vented? To find out we closed the vent manifold before the next altitude cycle. At 25,000 feet it was obvious that we were in trouble; the door bulge was approximately four-tenths of an inch. We decided to decrease pressure still further and, at 26,000 feet, the compartment door buckled, pulling the door mounted latch strikers from under the latch rollers. The door was forced open 30 to 35 degrees by the expanding raft and the CO_2 cylinder was lifted five inches off the support trough. Had this been a live cylinder, it would have discharged at this time.

With this test we were able, in effect, to exactly duplicate the sequence of events which have lead to the majority of our life raft losses. Remember, this raft had previously been to 35,000 feet with the vent manifold open. Now, a lot of airplanes have this vent installed, so why are we still losing rafts? For the same reason that we have always lost rafts. Between a lack of understanding of the part configuration and function, some built in "Murphy" features, and carelessness, we are not getting maximum value from this part. We know of several cases in which the check elements were not removed from the raft inlets when the old manifold was replaced with the vent. With the check elements still in the raft, entrapped gas cannot escape and the vent is useless. In another instance, at a midwest base 80 raft installations were inspected on operational aircraft and, in each case, the vent manifold was found in the closed position. Someone just hadn't done his homework.



Above, modified vent manifold (life raft compartment) in closed venting position.

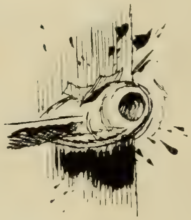
Right, modified vent manifold in open venting position.



The manifold utilizes an O-ring detent to hold the vent plunger open. Unless the installing document is carefully studied, and the internal configuration of the vent understood, it is impossible to externally determine if the vent is open or closed. Try it, hand someone a vent manifold and the part number 717 tool. Chances are that the person will pull the plunger out and announce that he has it in the venting position which, of course, is wrong. To overcome this problem, we modified the unit used on our test article. The change consisted of machining a slot three eighths of an inch wide and a tenth of an inch deep in the removable cap of the manifold. The exposed portion of the vent plunger was painted insignia red around the periphery. This provides an exposed red warning when the vent is closed and, when properly open, the technician sees only the flush, brass end of the plunger (note illustration). This is a cheap, effective change that can easily be accomplished on all your units.

Finally, one of the most important tasks to be accomplished in overcoming the raft problem is to make sure that adequately trained people are doing the installing. A concise, well illustrated life raft publication would be a tremendous help. ★

Aerobits



TAXI TRAP. After about 5000 feet the taxi line turned right to steer around a hangar building on the left of the ramp. The scanner indicated it would be close. The pilot slowed to a crawl and moved to the right as far as taxi lights would allow. (Taxi lights on the right were moved in from the edge of the ramp to keep aircraft off a portion of the ramp needing repair.) The pilot in the right seat was checking clearance. He saw that the wing tip was too close to the hangar, but he could not transmit on interphone due to a loose mike connection. The pilot realized he was too close and applied brakes. The aircraft came to a stop just as the outboard half of the heater pod contacted the hangar. Operator error. AFR 60-11 requires wing walkers within 25 feet and tugs within 10 feet.

HOT WAX-HOT AMMO — A staff sergeant and a civilian with combined experience of 25 years recently proved that all that time on the job won't of itself prevent an accident. They were inspecting 20 mm. ammunition. The procedure called for the container to be opened, ammunition inspected, and container closed and resealed. Resealing consisted of taping the cover to the container then dipping the top of the can in hot wax. During this process the weight of the ammo was too great for the tape on one can to hold and the lid came off permitting the ammo to fall into the hot wax tank. The men immediately removed the electrical plug from the tank and evacuated the building. About five minutes later, eight rounds of the ammo went off rupturing the tank and allowing the hot wax to escape.

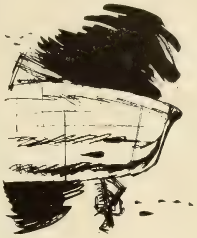
P.S. SOPs are being revised to require use of a wire mesh basket to hold the containers being dipped.

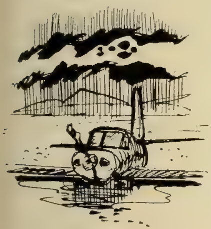
FUMES — About 10 minutes after takeoff, at an altitude of 8000 feet, the navigator began to feel "woozy." He got out of his seat and took a couple of steps toward the bunk then passed out and fell down. Noticing this, the first pilot got him back into the navigator's chair and placed the oxygen mask on the man's face. On 100 per cent oxygen he quickly recovered.

The flight surgeon met the aircraft when it landed and immediately took the navigator to the hospital for examination. A blood sample taken 2½ hours after the navigator passed out showed between 10 and 20 per cent carbon monoxide saturation. The medics speculated that the level could have been as high as 30 per cent but that the victim would not have noticed any problem so long as he remained at sea level. The higher altitude in flight changed the picture.

Prior to takeoff, a large truck was off-loaded from the aircraft, a C-124. This took considerable time. The truck engine was running and the exhaust fumes filled the cargo compartment and drifted up to the flight deck where the navigator was. With the truck off-loaded, the aircraft took off without being properly ventilated. At 8000 feet the navigator passed out and one of the pilots also felt "woozy" for a time.

GUN ARMING FIRE. Wiring entering the power cannon plug directly behind the top right gun of the F-86 is of close tolerance and charging the gun can cause chafing of the wiring. As a weapons mechanic was arming the guns in the arming area prior to flight the top right gun was charged once without problems, but, as the second round was charged, the gun bay ignited in a flash, began smoldering, then the entire gun bay was engulfed in flames. The initial flash was caused by the cable arcing from a live wire to the rear of the gun butt of the top gun. At this point, as the armorer released the handle, the cable jumped over the top pulley and fell across the hydraulic line and shorted itself to the DC power relay, burning a small hole in the hydraulic line and releasing atomized fluid from a 3000-pound pressure line. This fluid ignited. The canopy was melted and the seat headrest was burned. The pilot evacuated the cockpit immediately after the initial flash, but received first and second degree burns on the neck and right arm.





COCKPIT CONFUSION — While taxiing toward the parking area the aero club pilot had to add power to get over a light snow ridge. In so doing he lost control and attempted to stop by applying brakes — toe brakes. This airplane, a Cherokee, has no toe brakes, only a hand brake mounted between the front seat occupants. The IP scratched his hand on the ash tray while grabbing for the brakes but managed to get the machine stopped. Damage to prop and fuselage was estimated at $90.

The student was familiar with other light aircraft with toe brakes but was unaware that this plane has only a hand brake. The instructor was tagged with supervisory error for not familiarizing the student with the unusual brake control.

Another aircraft at another base received damage estimated at $266 as the result of the pilot actuating the gear switch instead of the flap switch while taxiing.

These mishaps as well as others indicate that more attention should be given to thorough cockpit checkout. Ignorance on the student's part of where the brake control is located and use of gear instead of flap switch point to laxity on the part of instructors.

PILOT-TO-FORECASTER SERVICE — The subject of radio discipline now comes up as a problem area on METRO channel 13. Forecasters in busy areas handle up to 3500 completed contacts per month in which information is exchanged. There are many more contacts initiated and answered but in which the desired information is not obtained. This boils down to some pretty busy periods, since obviously the contacts are concentrated into periods of bad weather and daylight hours, the latter because that's when we do most of our flying.

A frequent complaint is that some pilots don't assure the channel is clear before making a call. We tend to do this because we are usually in a hurry to get back on center frequency. Another problem arises when a pilot doesn't check the enroute supplement for the nearest METRO. When he calls "Any METRO" he may very well get more than one reply. This can set up a state of confusion on the ground since METROs cannot hear one another.

It is well to remember that channel 13 is first priority for the forecaster. He will drop what he is doing in order to assist you. Radio discipline on channel 13 is consideration for other pilots as well as the forecaster who is trying to give the service. Air Weather Service is attempting to obtain additional PFSV frequencies which will help to relieve the congested conditions. Incidentally METRO is interested in your flight conditions. The PIREP format is contained in the Enroute Supplement.

Aerobits

TIGHTEN THAT BELT — Many years ago, when the writer was learning about flying from the back seat of a Stearman, these words came through the Gosport, "Got your seat belt fastened?" A downward glance showed the buckle to be fastened so we nodded at the steely eyes staring out of the little mirror. Immediately the plane snapped inverted. And, immediately, a shocked and scared student dropped to the extremes of the loose seat belt. Scrambling feet couldn't find the pedals, the top of the stick could barely be reached with the tips of the fingers, and dirt falling from the floor of the cockpit caught the slipstream and stung as it whipped into an unprotected face.

When, finally, the Stearman was right side up again and a desperate yank had cinched the belt firmly into the midsection we noticed that the normally mirthless eyes in the mirror were filled with tears of laughter. We never quite forgave old "Iceheart" for that lesson, but we never forgot it either.

Why recall it now? Because, in our seat belt equipped car, we still have the habit of drawing the belt snug. But a lot of our passengers don't. In fact, many, were it not for the discomfort of sitting on the steel buckles, probably wouldn't avail themselves of this little extra.

There's been quite a bit of publicity about installing seat belts in The Great American Death Dealer, and considerable about using this life insurance. But have you considered the relative merit of restraining your head halfway through the windshield with a loose seat belt as compared to letting it go all the way through with no belt? Better, of course, to snug that belt down and bounce the noggin off the padded dash.

Everyone knows accidents happen to the "other guy," but the "other guy" might be the one you're riding with someday.

WAY OF LIFE—Because of the transport flying commitments and anxiety to accomplish the mission, we as aircraft commanders sometimes are responsible for flying the organization into the "hole." We do this over a period of time by accepting marginally performing aircraft — aircraft where the same components malfunction flight after flight. Instead of demanding that these malfunctions be corrected, we begin to accept these marginal performing aircraft with a shrug of the shoulders and a — "well, this is the way of life." This is not the way of life nor is this attitude conducive to the fulfillment of any peacetime transport mission.

To prevent getting into the hole or to help get out, there are two things all aircrews must remember. First, is the Dash One: your bible. If the aircraft systems and subsystems are out of limits as specified in the Dash One, get 'em fixed! Don't compromise any system which is directly related *in your mind* as a safety of flight item. You owe this to your aircrew and organization. Second, confer with the maintenance officer and establish some type of system to detect repeat writeups in the AF 781A.

Following a recent major accident the aircraft accident investigating board discovered the aircraft involved had experienced 10 repeat write-ups on 10 consecutive flights prior to the accident. Seems impossible, but it happened.

Demand the best and you will receive the best. Accept substandard aircraft and this will become "a way of life."

Maj William M Bailey, Jr
Directorate of Aerospace Safety

☆ U. S. GOVERNMENT PRINTING OFFICE 1965 751-220/12

WELL DONE

CAPTAIN HENRY P. FOGG

DET 6, CENTRAL AIR RESCUE CENTER (MATS)
KINCHELOE AFB, MICHIGAN

Captain Henry P. Fogg was the Instructor Pilot. The mission was an area checkout for a newly assigned HH-43B helicopter pilot at Kincheloe Air Force Base. The pre-mission briefing included all emergency procedures with particular attention given to the importance of planning areas for autorotative landings. The flight would be over some of the roughest terrain in North America — the heavily forested North Woods and the rough undulating terrain of Michigan's Upper Peninsula.

After a routine take off, the helicopter reached an altitude of 700 feet and leveled off on a heading of 330 degrees. A base access road was followed as far as possible. As the last suitable road for autorotation was left, a quick check of all instruments indicated that all readings were normal. After completing this check, Captain Fogg attempted to find the next suitable site for an autorotation. As he was looking for this site a loud explosion was heard. A check of the instruments revealed the engine had failed! Captain Fogg began an immediate autorotative right turn to the road they had crossed a few seconds earlier. As the turn was made, it was obvious that the distance and hazards of telephone poles, lines, and trees would make the landing very difficult, and the flight path would have to be altered so there would be sufficient RPM to clear obstacles. The only landing area on the highway required that the helicopter complete a 240-degree turn which meant that it was landed with a quartering tail wind of approximately 15 knots. The final flare before touchdown was made rapidly to build rotor RPM lost in evading a pine tree near the intended landing site. The touchdown was made smoothly and the helicopter came to rest with its sling hook only inches away from the centerline of the highway.

While coping with this emergency, Captain Fogg demonstrated his professionalism by making an emergency call to Kincheloe tower before landing on the highway. Once on the highway it was impossible to contact the tower by radio. WELL DONE! ★

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

OCTOBER 1965

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AEROSPACE SAFETY

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FALLOUT

F-4C MURPHYS

Request you send the list of F-4C Murphys which has been consolidated, per the article titled "Let's Coldcock Ol' Murph!", page 13 of the August issue of AEROSPACE SAFETY. Since the 33d Tac Fighter Wing has just been activated, we do not have any Murphys, but we will be happy to pass along any new ones we find as we progress into full scale maintenance.

2/Lt Warren D. Hilton
Eglin AFB, Florida

ONE INCH TO SURVIVAL

I suppose you have or will receive a number of letters about your story "One Inch To Survival" in the August issue. After reading that the pilot received a low-low reading of 29.68 (in the opening second sentence) and then (in the second paragraph, second sentence) of the pilot indicating that he received a low-low reading of 28.68, I am in doubt as to what he did receive.

I suspect the reading of 28.68, as given in the second paragraph, second sentence, should be 29.68 to be entirely consistent.

Regardless of the above, it is an incident that has happened. Our answer to preventing this hazard at our weather detachment is this: When the weather observation is disseminated via electrowriter to using agencies, the tower operator immediately checks with his altimeter and if a significant discrepancy exists, he immediately calls the weather observer who, in turn, sends out a correction.

Maj Victor A. Schmidt
Det 12, 15 Wea Sq (MATS)
Olmstead AFB, Pa.

Someone wrote a sloppy 8 that looked like a 9. This could have been fatal. We like your method of preventing this sort of thing. Thanks for writing.

ABOUT THE COVER

A 250-ton behemoth rises from the ground, flies thousands of miles at speeds approaching the speed of sound. Sounds difficult. But it happens every day — each time a B-52 lifts off the runway. When this complex machine is mated with its highly skilled crew the whole becomes greater than the sum of its individual parts.

The following article was adapted from the South Dakota Conservation DIGEST. It is aimed primarily at hunters, but is applicable to Air Force personnel, be they out hunting or down in remote areas as a result of ejection, or aircraft crash.

LOST? WHO, ME?

First to be considered should be proper clothing and equipment. In regard to the color of hunting clothes: for safety reasons we recommend fluorescent yellow-orange, bright yellow or red. Be sure you will be warm enough and that your feet will stay dry. Have a good cap and warm gloves or mittens. Other necessary items should include a watch, knife, compass and plenty of matches (preferably in a waterproof case). It's also a good idea to have an apple and a candy bar or two in your coat pocket.

Rule number one is to not get excited or panicky. This is the greatest single danger of being lost. Stay calm and stand still for a minute until your good judgment has complete control. No good will come of starting out blindly. In fact, an excited person, running or walking fast, can easily fall and get hurt, even drop from exhaustion or a heart attack. Often, after a little rest and calming down, things seem to fall into place and the situation is far less grim.

Assuming you are still confused, if you have a compass you should be able to chart a course and stick to it. In following a compass remember to take frequent sightings on a tall tree, mountain peak or other land mark in the direction you wish to travel, otherwise you can end up walking in a circle. Believe what your compass tells you even though you may feel that it must be wrong.

If you have no compass, but the sun is visible, of course you can get your direction fairly well from it. You can be even more accurate with the use of your watch and the sun. Hold your watch so that the hour hand is pointing toward the sun. Half way between the hour hand and 12 o'clock is south. On a clear night, remember that the two stars forming the side of the Big Dipper away from the handle, point straight up toward the North Star.

But it is an overcast day, perhaps it is even snowing and you do not have a compass. There are three other alternatives:

If there is snow on the ground the best thing to do is to back track yourself out the way you came in. I'll admit that I have done this a couple of times.

In case there is no snow, or your tracks have drifted in, then we will go to my second choice. This is simply a matter of going down hill. Each drainage you follow down will join another until you come to a trail or side road and eventually even a traveled road or highway where you can catch a ride. This down hill trick is especially good in the Black Hills.

Perhaps for some reason or other you can not use either of these two plans. Maybe you feel it is too late in the day to try to get out; you are too tired or have sprained an ankle or broken a leg. Then we must go to our third choice.

This choice involves finding a sheltered area out of the wind. Gather some firewood and settle down for the night. At about this time or before is when most lost hunters start shooting up all their shells, having heard that three shots are a signal for help. During daylight hours in particular this will probably not accomplish anything except to use up your ammunition. If there is a hunting season in progress your shots will not sound any different from the others. Of course, after dark, if you are really in need of help because you are sick or hurt, it may be the thing to do, particularly if you hear a vehicle or voices nearby.

You will probably have to stay awake all night to keep a small fire going, but you will be all right in the morning aside from being tired, a little cold and real hungry. Here is where those candy bars and apples would have come in real handy. When daylight arrives, unless your directions have straightened out, you are ready to start the downhill hike. Remember to be sure your fire is completely out.

Being lost is a serious, dangerous situation. But, by keeping your head, planning, and following your plan, you can count on resolving your problem in the safest possible way. ★

Darrell Brady, Asst Chief Warden, Div. of Law Enforcement
Dept. of Game, Fish, and Parks, Rapid City, South Dakota

IFR-VFR

HAVE ONE... BUT NOT THE OTHER

Lt Col Merle B. Nichols, Directorate of Aerospace Safety

The winter morning chill caused the cattle to turn their rumps into the wind as they huddled together for warmth. Inside the pickup truck the farmer was snug with the heater full up. Slowly the truck bumped along the country road as the man peered through the swirling snowflakes, checking fences and noting the condition of his livestock.

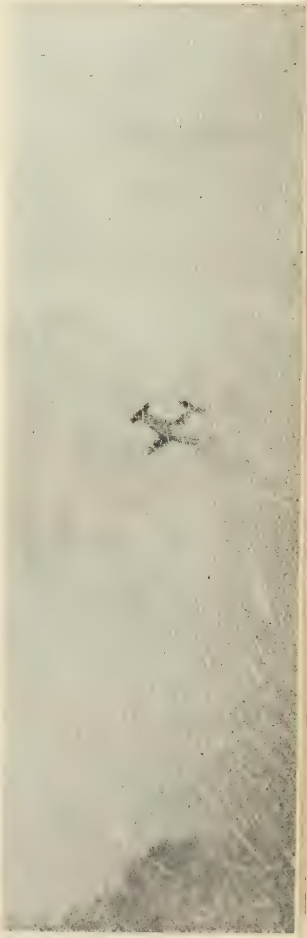
As the truck made a turn and started down a narrow lane between two fields, the farmer squinted into the gloom trying to penetrate the flaky curtain that veiled some strange form far out in the field. He stopped the truck, turned up the collar of his heavy coat, then reluctantly opening the door, he stepped out into the cold.

Twenty minutes later he was talking to the State Police on the telephone.

"Yes, it's an Air Force plane, can tell by the markings . . . only one man – he's dead . . . "

Earlier that morning squadron pilots assembled for the 0730 briefing with the operations officer presiding. First order of business was the weather briefing:

As of 0745 the report was 6000 broken to overcast, visibility 15 miles plus. A surface low with occluded front was located northwest of the base with the low center moving southwest at 5-10 knots bringing light snow with it. The forecast was for 4000 broken, 8000 overcast, visibility 10 miles with snow. Alternate bases and the briefing officer were designated.



After calling the weapons director at Air Defense Sector Headquarters, the briefing officer announced the mission. It would be a low level — three interceptors, with a T-33 as the target aircraft.

At 0800, the T-33 pilot arrived just as the general briefing ended. His late arrival required a specific briefing just for his benefit. Emphasis was placed on the fact that the target aircraft would be on a VFR flight plan. If VFR conditions could not be maintained, the pilot was to either return to base VFR or obtain an IFR clearance.

At 0830, the T-33 pilot arrived at the aircraft, completed the preflight and looked around for his passenger, a maintenance airman. Fate was in the airman's corner — the man failed to arrive in time and departure (0910) was made with an empty rear seat.

The mission was more or less routine, and at 1000 hours the flight leader requested and received vectors for one last intercept each. As the interceptors maneuvered for position to commence their run (weather now 5000 feet MSL — 3000 feet AGL) the target pilot called, "I'm descending lower to remain in the clear."

The interceptor pilots later reported that as they continued with the last intercept, the weather, like a funnel, forced them to descend. Horizon references were lost, and the ground was obscured by fog. They could not see the T-33 target, now six to eight miles in front of them.

Interceptor Nr 1 completed his run on Nr 3, climbed to altitude and headed home. Interceptor Nr 2 descended to 4000 feet, saw the two interceptors ahead, turned to the west, climbed to altitude and, like Nr 1, headed home. Nr 3 called, "breaking off," saw Nr 1 pass off his right wing, then glanced at his altimeter, read 3000 feet and looked to his left — "hills!" Afterburner! Pull up!

He entered the overcast at 3500 feet, broke out on top and pointed the nose toward home.

Meanwhile the pilot of the target aircraft began a left turn. Witnesses later stated that the weather was variable snow showers and changing visibility. The pilot was either too low when he started the turn or he allowed the aircraft to descend in the turn.

He crashed at 1010.

The board decided that the most probable cause of the accident was "Pilot factor in that the pilot allowed his aircraft to descend into the ground during IFR condition due to disorientation, vertigo, distraction or an attempt to maintain VFR while in IFR conditions." There were other probable and possible causes, but this one sounds important to me — "Pilot factor in that the pilot violated AFR 60-16 and his mission briefing by failing to maintain VFR."

Now, let's review a bit. The interceptor pilots all came to the same conclusion at about the same time — *the weather would not allow continuation of the mission.* They altered their flight plans, climbed to a safe altitude and headed home. The target pilot also changed his altitude and direction of flight but the procedure he used, VFR, IFR, or a combination of both could never be specifically determined by the board. Nor could his final maneuver be determined.

Now if you are a pilot, let's hope that you recognize the hazards of partial visual — partial instrument flying. If you are a commander, how about reviewing your operation and make sure that you have an adequate policy that will terminate training missions and maneuvers when the encountered weather makes their safe completion questionable.

PILOTS NOTE: It has not been my intent to imply that if you're 30 minutes late for the morning briefing your succeeding flight will end in disaster. If, however, you have ever been late for an important engagement, you will recall that it usually causes deep concern, a feeling of anxiety or at least pangs of conscience. Don't let this feeling drive you into a corner from which there is no escape. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. Is the holding pattern entry depicted on the upper right corner of approach procedure charts directive upon pilots?

A. Not specifically. As it says in FLIP II: "Holding pattern entry procedures shown on high altitude instrument approach charts are provided as a pilot convenience." However, AFR 60-16 does require you to comply with the entry procedures outlined in FLIP II, so it is, in fact, a visual aid for a required maneuver. Incidentally, had you noticed that the group of headings depicting the TD entry sector are drawn 40 degrees on each side of the applicable tear drop heading?

Q. What is the meaning of the symbol $\overline{4000}$ on the high altitude approach chart for the James Connally VOR/ADF approach?

A. The symbol $\overline{4000}$ designates a maximum altitude for that portion of the approach. Prior to the next time you report leaving an altitude you ought to review the important format change sheet posted near the front of the latest FLIP (Terminal).

Q. The guidance for flying through Intensive Student Jet Training Areas was deleted from the Special Notices some time ago. When can I fly through these areas and what procedures must I follow?

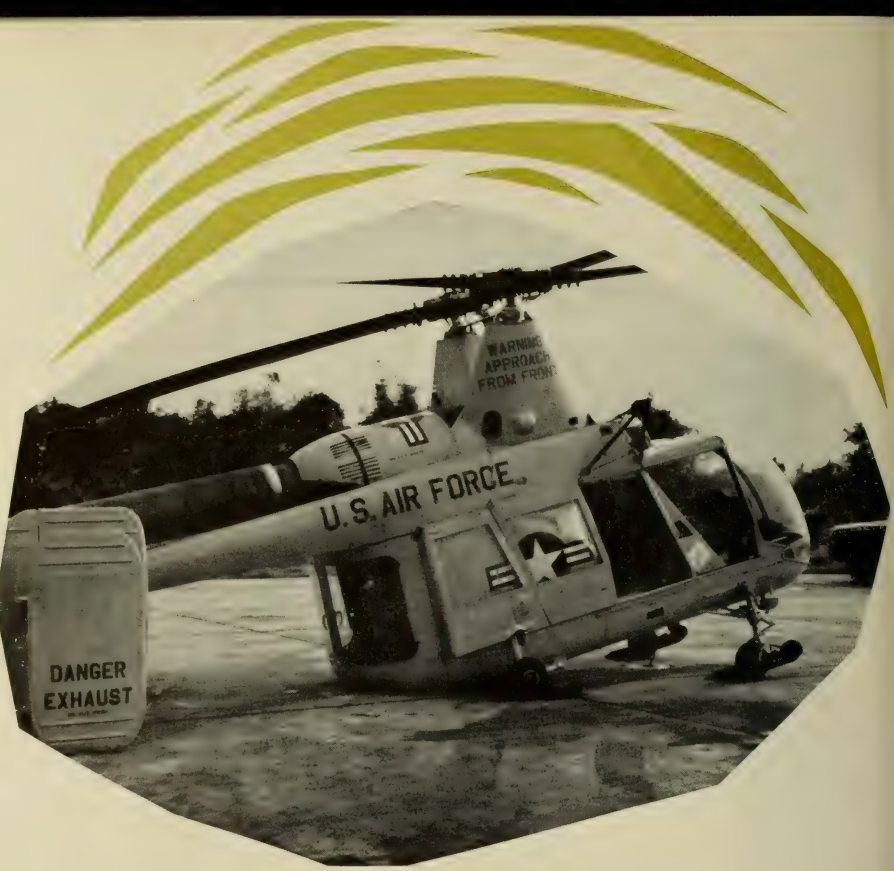
A. There are no specific rules. The local FSS, Center, or tower can provide advisory service to the pilot as to whether or not the area is in use.

Q. I recently had occasion to study the TACAN approaches to Cannon AFB, New Mexico. Do you know why there is such a difference of minimums between TACAN #1 and TACAN #2? The minimums for TACAN 1 are 300-1 and the final approach course is 040 degrees to runway 03, or a ten degree angle. TACAN 2 has a final approach course of 027 degrees, only three degrees from the runway; yet, its minimums are 500-1.

A. JAFM 55-9 (Manual of Criteria for Standard Instrument Approach Procedures) states that "The final approach radial is that TACAN radial which will bring the aircraft to the point of interception with the runway *or* the runway center line extended. For a straight-in approach to a specific runway, the acute angle (angle of interception) formed by intersection of the final approach radial and the runway center line extended shall under no circumstances, exceed 20 degrees . . . " If you extend the center line of runway 03, you will find that 040 degrees, the final approach course for TACAN 1, intercepts the extended center line at approximately one mile, and forms a ten-degree interception angle. However, the final approach course on TACAN 2 does not cross the center line extended until you have passed the airfield. So, even though you may be in better position for a landing on TACAN #2, the criteria as outlined in JAFM 55-9 for straight-in approaches are not met and circling minimums apply.

POINT TO PONDER

Have you heard about the rule-of-thumb that can be used to determine the amount of pitch change necessary to produce desired changes in vertical velocity? TAS or Mach number directly affect the amount of vertical velocity that will result from a pitch change. A one-degree pitch change will result in a change in vertical velocity equal to the Mach number times one thousand. For example, at .5 Mach a one-degree pitch change will result in .5 times 100 = 500 feet per minute. There are numerous applications of this technique. The next time you want to demonstrate a precise descent of 1000 feet per minute glance at the Mach indicator. "Let's see, at my present Mach of .4, a one-degree pitch change will produce 400 feet per minute, so I'll change my pitch attitude about 2½ degrees to produce 1000 feet per minute." The technique can also be used during level-off from a climb. Assume you are climbing at .6 Mach and the vertical velocity is 1200 feet per minute. "Let's see, at .6 Mach a one-degree pitch change will change my vertical velocity by approximately 600 feet. When I reach the lead point for my level-off, I will lower the nose two degrees so as to establish a level flight attitude." This technique helps compensate for attitude indicators which precess or have to be reset after level-off from a climb. Try it, you will be both pleased and proud of your newly-acquired skill. ★



Lt Col Robert E. Englebretson, Directorate of Aerospace Safety

At 1530 local time the HH-43B helicopter took off on a scheduled one hour base support mission. Purpose of the flight was to perform a security check of the base perimeters and to acquaint the base commander with the location of a proposed fire pit training area and building site for relocation of the helicopter alert facilities. A local flight clearance had been filed by the pilot and a TOLD card completed. The crew consisted of the pilot and copilot with a passenger (base commander) occupying the copilot's seat.

During the first 50 minutes, the base perimeter was inspected with the aircraft remaining within five miles of the base at all times. The helicopter was then flown to one of the hardstands and landed. The building site was pointed out to the base commander and a short discussion held over the aircraft intercom. The pilot then made a takeoff to a five-foot hover and a 270-degree turn to afford a better view of the area. From a position on the east edge of the hardstand and while moving forward at approximately five knots, the pilot decided to land the aircraft on the hardstand again. During this portion of the flight there was no conversation over the intercom and no actions taken that would have unduly distracted the pilot. He decided to touch down while maintaining his forward movement. However, realizing that his rate of descent was higher than normal, he attempted to slow his descending movement by application of aft cyclic stick which raised the nose of the aircraft. As the nose came up, the pilot did not add sufficient collective pitch to slow the rate of descent because he did not think the aircraft was descending fast enough to cause an overly hard landing. The aircraft touched down in this attitude and rolled and skidded forward approximately 8.5 feet.

After the helicopter came to a stop the copilot got out and observed that the main gear shock

ARD ANDING HOPPER TYLE

struts had penetrated the side of the fuselage. He then gave the pilot the shutdown signal.

Thorough investigation of the possibility that the passenger distracted the pilot revealed that although the base commander occupied the copilot's seat, his presence had no bearing on the accident. At no time during the flight did he fly the aircraft. He did place his hand on the cyclic control to actuate the interphone. However, immediately prior to and during the landing which resulted in aircraft damage, he was not touching any aircraft control nor was he talking to the pilot.

Sun glare was investigated as a possible distraction factor but was discounted.

The board investigated and ruled out the possibility of distraction caused by either the presence of a flight of jet aircraft or ramp traffic.

Finally, the board concluded that at the moment of touchdown the helicopter encountered ground resonance. Close examination of the main tire marks showed that the left main gear contacted the concrete first, followed closely by the right main gear. The right main gear shock strut and fitting and a small surrounding portion of the aircraft skin penetrated the fuselage after shearing the right main gear attaching bolt. This was followed by a stripping of the threads of the left main gear shock strut attaching bolt in the area of a gear fitting modification, which allowed the left main gear shock strut and fitting and surrounding skin area of the fuselage to tear loose and penetrate the cabin. The fact that the aircraft touched down with more force on the left gear than the right, coupled with the fact that the right gear penetrated the fuselage with more force than the left, indicated the beginning of ground resonance.

One of the prime conditions required to induce ground resonance in the H-43B is that the aircraft be light on the front tires or that the front tires be off the ground. Increased gross weight aggravates this condition. During this landing a nose high attitude and high gross weight conditions were present. Although the weight of the aircraft (estimated at the time of the accident to be 6100 pounds) was not heavy, it was believed by the board that conditions similar to high gross weight were induced by (1) a faster than normal rate of descent, and further aggravated at touchdown by (2) a fairly rapid rotation of the aircraft from a level descending attitude to that of a nose high attitude with simultaneous contact with the ramp.

The following facts are based on the experience of the board members in investigating previous H-43 accidents which indicates that the damage was not caused solely by a hard landing.

- H-43 accidents that have resulted in main gear damage as a result of a hard landing have had accompanying damage to one or more of the following areas: tail boom, rotor blades and flaps and auxiliary (nose) gear.
- Conversely, in several instances of H-43 accidents where ground contact was known to be severe, there was no damage to the main landing gear fitting area, although in each case there was damage to other major components.

The possibility of materiel failure in the area of the main landing gear fitting assemblies could not be ruled out. The landing gear main attaching bolt on both the left and right fitting assemblies failed upon intial ground contact.

Examination of the fitting assemblies revealed that the aircraft had been modified at a previous station with a steel strap manufactured from 1/8 inch steel stock approximately one and one-quarter inches by five inches.

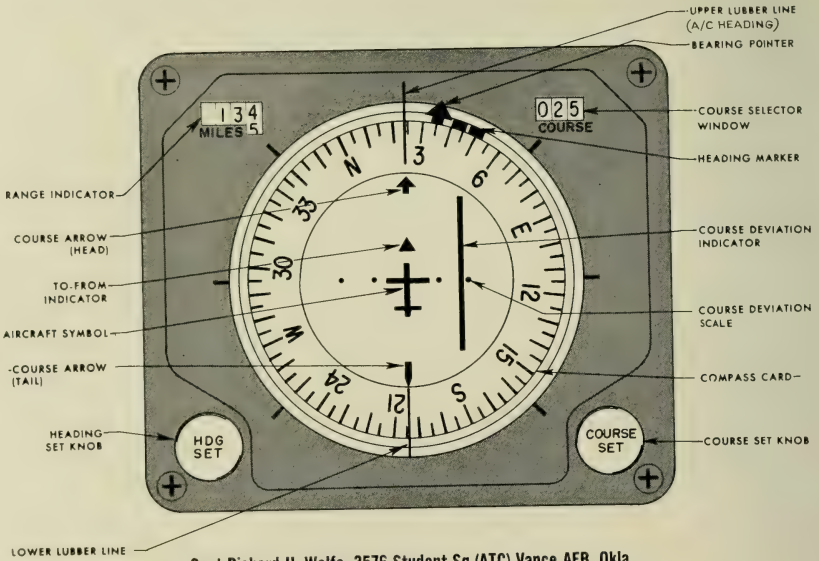
In addition to this helicopter having been used in a student training program, it had been loaded and unloaded several times aboard cargo aircraft while being airlifted to various ZI and overseas bases. Also it had suffered several shrapnel hits and explosive damage during a mortar attack. This combination of unusual stresses possibly could have weakened the main landing gear fitting assemblies.

The investigating board decided the primary cause was pilot factor because the pilot, in attempting to reduce rate of descent during landing from a hover applied aft cyclic control and an insufficient amount of collective control to cushion the landing. This action allowed the helicopter to strike the ground at a rate of descent higher than normal, creating undue stress on the main landing gear shock struts.

A contributing cause was ground resonance. The aft cyclic control applied during touchdown coupled with the harder than normal landing forces induced the beginning of ground resonance which caused the main landing gear shock strut attaching points to fail.

A possible contributing cause was materiel failure in the area of the main landing gear shock strut fitting assemblies ★

Hazy on HSI?



Capt Richard H. Wolfe, 3576 Student Sq (ATC) Vance AFB, Okla.
(Illustrations by SSgt L. W. Chisholm)

Many pilots are now flying aircraft which incorporate either the Integrated Flight Instrument System or the Flight Director System. These jocks should be pretty familiar with the Horizontal Situation Indicator (HSI) and they can find out if they know the equipment as well as they thought by filling in the six missing indications for each of the seven situations given here.

TACAN is used as the Navigation aid in these situations but remember that some designs enable VOR, ADF or ILS to be played through the system.

Now, how about the rest of the pilots who know little or nothing about these new fangled systems? Here's a picture of an honest to goodness Horizontal Situation Indicator (HSI) (above). One quick glance reveals that there's a lot of information presented on this HSI. The instrument is essentially a combination Course Indicator (ID-249) and an RMI (ID-250). The big advantages of the HSI are that it lets you "see" exactly where you are in relation to the TACAN station and in relation to the course which you have selected. It also provides for an easy and more natural cross-check. Here's some background information that should help you prior to starting the quiz:

- Compass Card: Generally operates like an RMI, aircraft heading is under the upper lubber line.
- Aircraft Symbol: Fixed, always in the same position.
- Range Indicator: Presents slant range to the TACAN station in nautical miles.
- Bearing Pointer: Gives magnetic bearing to the TACAN station. The radial that you are on would be the reciprocal of the magnetic bearing under the bearing pointed. You can "see" relative bearing in relation to the fixed aircraft symbol.
- Course Arrow: The head of the arrow points to the course you have selected (this course is repeated in the course selector window).
- Course Deviation Indicator (CDI): The CDI is ALWAYS DIRECTIONAL with TACAN and will indicate where the selected course is in relation to your position (aircraft symbol). The entire CDI will rotate with the compass card as the aircraft turns, and the CDI ALWAYS remains parallel to the course arrow. The picture displayed on the HSI is as though you were looking down and could see your aircraft in relation to an imaginary course line drawn on the ground. For TACAN (same as ID-

TRY THIS QUIZ

249 for VOR), the course deviation inner dot represents a five-degree deviation from the selected course and the outer dot a 10-degree deviation.

- TO-FROM Indicator: Appears just outside the aircraft symbol and is a triangular-shaped pointer. If the pointer points to the head of the course arrow you have a TO indication; if it points to the tail of the course arrow, you have a FROM indication. The TO-FROM tells you that the course selected, if intercepted and flown, will take you TO or FROM the station. Notice that anytime the bearing pointer is within 90 degrees of the head of the course arrow, you will have a TO indication, and anytime the bearing pointer is within 90 degrees of the tail of the course arrow, you will have a FROM indication.

As you probably have discovered, the bearing pointer, CDI and TO-FROM all function together and they give you a picture so that you can "see" where you are in relation to the TACAN station and the selected course. If you can readily orient yourself with the HSI you will be able to easily apply the desired TACAN procedure.

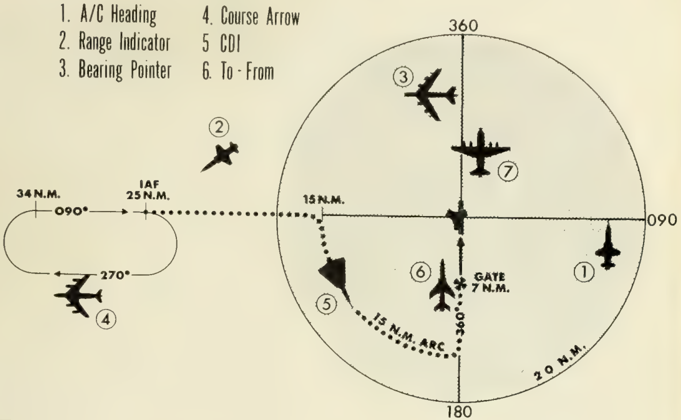
Now, let's try the quiz. You have seven situations: numbers one and three represent aircraft flying locally; number two illustrates a situation you might have if you were proceeding direct to an Initial Approach Fix or a Holding Fix. Number four places you in a holding pattern and number five represents maintaining an arc on a TACAN approach. Number six places you to the left of the TACAN gate, and number seven is a missed approach.

Try filling in the six missing indications for the number one and two situations and check page 10 to determine how you have done. Remember, the aircraft symbol is *you* in the miniature aircraft, and all your HSI information is in relation to the aircraft symbol.

Did OK? Finish the last five situations to tell if you are "Hazy on HSI?" (See page 13 for the answers.) ★

Draw in the following for each situation, using the order given:

1. A/C Heading
2. Range Indicator
3. Bearing Pointer
4. Course Arrow
5 CDI
6. To-From



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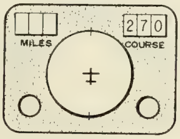

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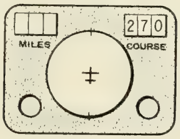

See page 10 for answers to questions 1 and 2 .

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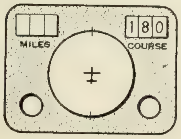

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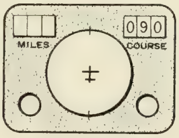

See page 13 for answers to questions 3 thru 7.

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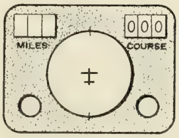

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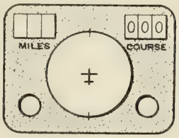

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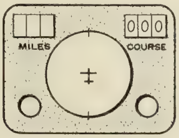

INFLIGHT WEATHER WATCH

Lt Col Jerry Creedon, AWS Liaison Officer, Directorate of Aerospace Safety

Are pilots fully aware of their inflight weather responsibilities? Recent OHRs indicate that some are not, hence the following. It is no small task to keep up with the ever-changing scene, so there may be a gem or two here that will hold the sweat factor down to a pint or so.

In a couple of similar situations recently, pilots encountered severe weather enroute. They properly called METRO to obtain the latest weather information, then diverted to alternates for safe landings. But they both considered it dangerous that they had not been advised enroute of the changes in the weather. Before we jump on the forecaster, we should realize that although weather warnings had not been issued, in both cases thunderstorms had been forecast.

Here's the point: *Pilots are responsible for maintaining their own weather watch while enroute.* With the high density traffic of today individual route metwatch is not feasible, but inflight information *is* available. Check your Enroute Supplement; it says that pilots are responsible for flight meteorological watch while enroute. It further says, "Call on 344.6 mc for updating forecasts, and FAA communications for SIGMET information."

Staying ahead of the weather is part of staying ahead of the aircraft. Remember, the weather forecaster is not expected to pass advisories to aircraft after departure except when he feels that a serious hazard to flight exists and that the pilot may not have had the opportunity to obtain this information, i.e., immediately after takeoff. Bear in mind that ATC's primary responsibility is traffic control, so passing of inflight advisories cannot be assured.

Here's a brief review of what is available to us with respect to flight meteorological watch while enroute:

- METRO for military weather warnings anywhere in the U.S. and other updated forecasts.
- VOR/TACAN broadcasts for SIGMETS every 15 minutes beginning on the hour. SIGMETS cover weather within a radius of 150 NM of the FSS broadcasting.
- VOR/TACAN broadcasts weather observations 15 and 45 minutes past the hour.
- FSS stations may provide direct pilot to forecaster service with an FAA briefer in event a METRO is not within reach.

Remember that military weather warnings and the USWB SIGMETS are issued independently. Don't expect the FAA facility to have military warnings. We should use all information available to us for making safety of flight decisions; however, severe weather limitations on your aircraft are based on military warning criteria. ★

Answers to HAZY ON HSI?

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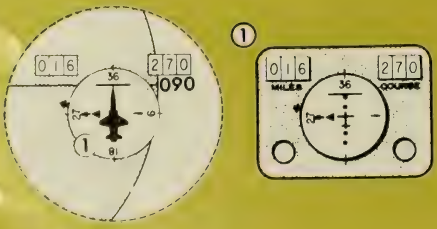

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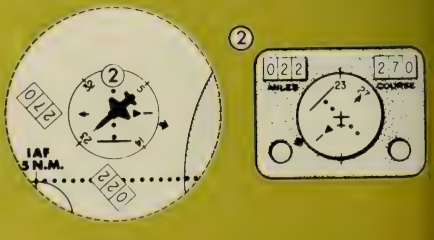
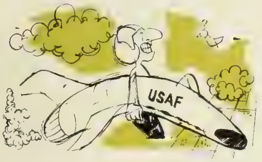


QUIT ASKING FOR IT!

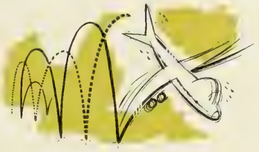
A. W. (Smokey) Dean, Hq AFLC, Wright-Patterson AFB

We in the Air Force Materiel Safety Office at Headquarters AFLC review all accident and incident reports to pick out and correct materiel failures and any trends that may be developing. This is our primary business; but in reading all these reports, we also see other things, like bird strikes, maintenance malpractice, and pilot error.

Now don't get huffy, pilot error is emphasized for a reason. You jocks are, by and large, good troops but sometimes you don't pay attention. Want some examples?



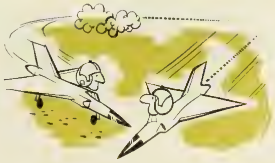
Take, for instance, the F-100 driver who reduced power to 79 per cent and when he brought it back in, it took one minute and 45 seconds to accelerate to MIL. This should have scared him, but it didn't because he tried it again (instead of leaving well enough alone) and flamed out. He was fortunate enough to get an airstart on the emergency fuel control.



A B-47 type ran into stiff elevator controls after a couple of hours of flight. Instead of making a landing ASAP, he elected to shoot a few low goes. After two or three, the controls really got tense and on round-out for a full stop, he bounced that stratojet all over the airpatch 'cause both he and the co-driver couldn't pull the yoke aft of neutral.

Two jocks in a hundred 'F' ran into one of those severe yaw situations and went sliding through the sky slaunchwise for a spell. This didn't bother them too much though because they charged around in the local area for another hour.

Seems the pilot got a fire warning light and power failure, but instead of shutting down, he taxied all the way back to Operations. 'Twas about a mile to Ops. When they opened the doors, of course, there was a fire!

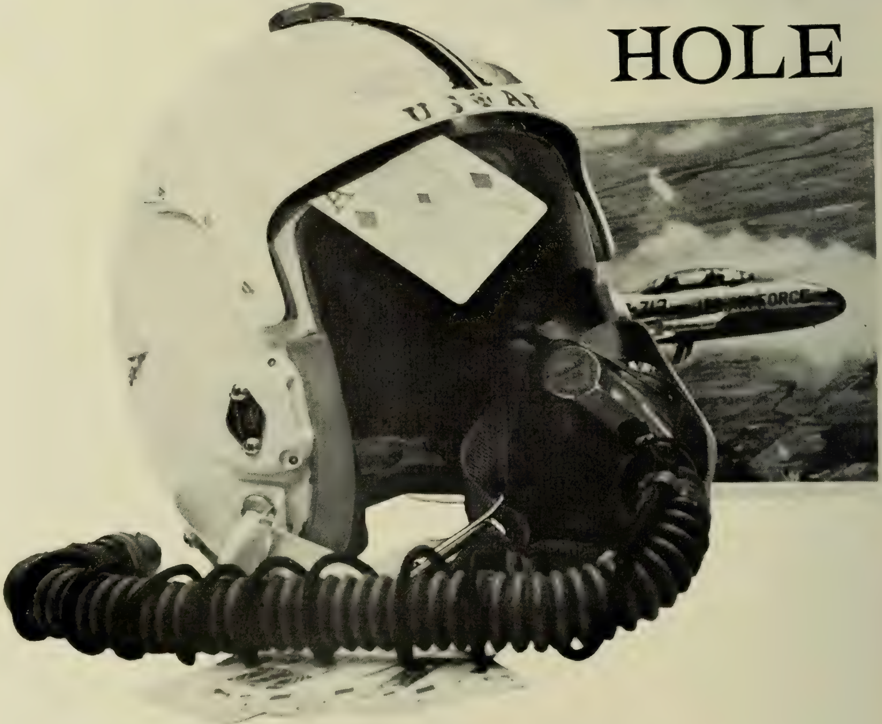


Here's the hairiest: An F-106B was making a wing takeoff and encountered a severe yaw toward the leader at approximately 115 knots. The IP took over, applied full opposite stick and rudder, and barely avoided a collision. The takeoff was *continued* – and the mission flown. Suppose these guys never heard of an abort?

Get the point? In case you didn't, we again emphasize:
WHEN SOMETHING UNUSUAL HAPPENS TO YOUR BIRD, LAND AS SOON AS POSSIBLE, OR ABORT. Quit asking for it! ★

THROTTLE LINKAGE FAILURE CAN MEAN
A LOSING HAND, UNLESS YOU HAVE . . .

THE ACE IN THE HOLE



Capt William O. Harris, III
ADV TM-63, APO San Francisco, Calif. 96296

Hey, you T-Bird jocks, if you tire of talking about women at the bar, here's another subject that might be to your liking. The subject is Throttle Linkage Failure. If you say that's a lousy subject for conversation you could be wrong, so bear with me a few lines more.

Recent information should restore some of the gray hairs you've acquired contemplating throttle linkage failure in the idle position.

As a quick review, the throttle can mechanically stick at any RPM. If it sticks at an RPM high enough to sustain flight the problem is relatively minor. But if the linkage fails, or breaks, the tension on the governor spring is released and the RPM decays to idle. Then you've got a giant size problem.

The Dash One says to place the Starting Fuel Switch to the manual position and you will get an approximate increase of 30 per cent RPM at low altitudes. This increase will generally be enough to get you into the SFO pattern for a safe landing. To quickly review, when the pilot places the Starting Fuel Switch to manual (with the throttle in the operating range) current is sent to the electrically controlled

Emergency By-Pass Valve which closes. This closing allows both the Main and Emergency Fuel Controls to feed to the engine at the same time, therefore the RPM increase of approximately 30 per cent at low altitude.

Now let's set the stage. You're solo in the T-Bird and you have throttle linkage failure in idle. You select Manual Fuel with the Starting Fuel Switch and you're running at about 67 per cent RPM. As you head for the field at about 180 knots, you're kinda pleased with the whole situation. You hit high key at the home base with 6000 feet of air below you with no problems. Now comes the dirty part: you misjudged the SFO and find yourself too far out on final approach. Now you've got a problem. You can't use the procedure mentioned in the Dash One concerning Manual Starting Fuel in one cockpit and Automatic Starting Fuel in the other because you've got no one in the rear bucket to help you. You quickly look again at the rising runway and decide that you're going to land very short and probably hit a ditch 3000 feet short of the overrun. This is not too appealing, so you decide to eject. Hold it a second — you've still got an Ace In The Hole! There is a procedure you can accomplish solo that will give the same results as Manual Starting Fuel in one cockpit and Automatic Starting Fuel in the other cockpit. This procedure is to select GANGSTART ON, after putting the Starting Fuel Switch to Manual, which will speed up the engine to a healthy 86 per cent RPM. Once the pilot realizes he is going to land short with 67 per cent RPM (obtained from Manual Starting Fuel) selection of GANGSTART ON can save the pattern, the pilot and the bird.

I can hear the mumbles now, "Where does that extra fuel come from?" Well, here's the answer. It comes from the Starting Fuel Control. What? I hear another mumble? "The Starting Fuel Control will not furnish fuel unless the throttle is stopcocked and in this case it's in idle." You're right, but as we all know, the T-Bird has been electrically modified and remodified so many times that it's an electrician's nightmare. One of these many modifications permits electric current to by-pass the opened micro switch on the Main Fuel Control which usually prevents use of the Starting Fuel Control with the throttle in the operating range. The current then goes to the Starting Fuel Control Inlet Valve which opens and allows fuel that is always trying to get into the Starting Fuel Control (from the Main and Emergency controls) to flow to the engine. This extra fuel accounts for the approximate 20 per cent rise above 67 per cent RPM. This same electrical malfunction is set up when you place the Starting Fuel Switch in the front cockpit to Manual and the Starting Fuel Switch in the rear cockpit to Automatic.

This procedure is not only good VFR, it can land you from a GCA or ILS if you are in weather. The 67 per cent gained from Manual Starting Fuel will sustain flight in the pattern and once you have set up your landing configuration, air speed can be maintained by selecting GANGSTART ON and GANGSTART OFF to keep the final airspeed at the recommended speed for your fuel load. Once the landing is assured, GANGSTART OFF will drop the RPM to 67 per cent for the last portion of the approach and, when you are ready to touch down, Starting Fuel Switch OFF will drop the RPM to IDLE and you touch down normally.

You may have noticed that in all procedures mentioned, the Starting Fuel Switch is placed in the Manual position before selecting GANGSTART ON or before turning the rear cockpit Starting Fuel Switch to Automatic. There is a reason for this: If you place the Starting Fuel Switch to Automatic, with the throttle in idle, nothing will happen, but then when you turn the other Starting Fuel Switch to Manual the whole increase of fuel flow will occur at once. This could cause an overspeed and overtemp of the engine. The same thing occurs if you select GANGSTART ON first. In this case the Emergency system will be turned on and the RPM will remain approximately the same. Then, just as before, when you select Starting Fuel Switch to Manual, the whole fuel increase will come at once. The procedure that should be followed is: Starting Fuel Switch Manual, then GANGSTART ON or rear cockpit Starting Fuel Switch to Automatic.

These procedures have been checked on 51 through 58 model T-Birds while completing more than 50 functional test flights. The procedure mentioned, concerning the solo pilot, has consistently given 82 to 88 per cent RPM at 5000 feet and below.

(An added note in the interest of safety. It would be wise indeed to check out the GANGSTART function early in the SFO pattern. We have no way of guaranteeing that it will work as we know it should.—Ed.)

I may have been wrong to insinuate that this procedure will replace talking about women at the bar, but it just might get you back safely one day, so you can talk about women at the bar. I hope so . . . ★

Answers to HAZY ON HSI?

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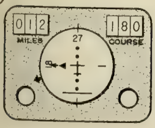

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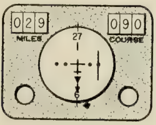

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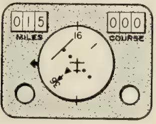

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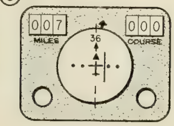

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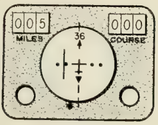


THE YAW MAKERS

The problem of yaw continues to be a big factor to be reckoned with in all airplanes. Yaw is defined as the movement of an airplane about its vertical axis. What can cause an airplane to move about its vertical axis? The pilot, of course, by a movement of one control, mainly the rudder. Too simple? Let's restate the question. What can cause an airplane to involuntarily (meaning other than the pilot's intended action) move about its vertical axis? Complicated? Somewhat, in the sense that there can be an almost countless number of answers to a condition that causes a pilot to compensate for his airplane's erratic flight.

Your first answer would most probably be "improper rigging." And right you may well be, except that pilots frequently squawk "pulls left," "right wing heavy," "flies ½-ball left," etc., in spite of the fact that the airplane had been signed off as properly rigged. So, for our purpose here, let us assume that proper rigging procedures are adhered to, and that the responsible people are thoroughly familiar with, and religiously follow, the "Dash Five" in this respect. But we still have yaw.

Take a long look at your airplane from the rear, standing at the center line about 30 feet aft of the tail, facing forward. Note that everything you see, including external stores and tanks, parallels the longitudinal axis (fuselage) of the airplane. Anything you spot that's off this line, or that hangs crooked, can create a drag in flight by causing a deflection of airflow about that area.

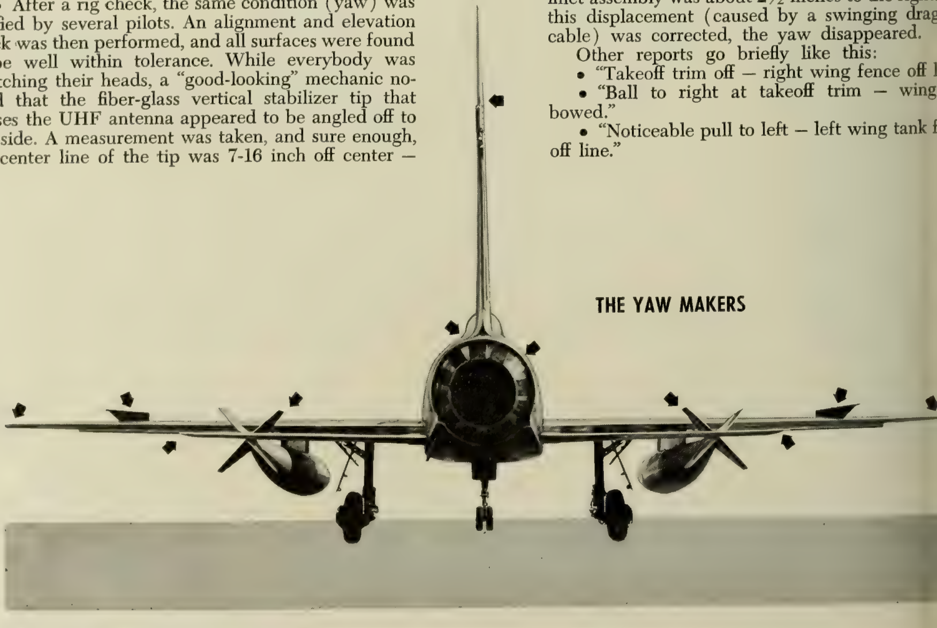
Here are a few examples of typical yaw makers that have been found as a result of taking a good look at the airplane:

- After a rig check, the same condition (yaw) was verified by several pilots. An alignment and elevation check was then performed, and all surfaces were found to be well within tolerance. While everybody was scratching their heads, a "good-looking" mechanic noticed that the fiber-glass vertical stabilizer tip that houses the UHF antenna appeared to be angled off to one side. A measurement was taken, and sure enough, the center line of the tip was 7-16 inch off center — yaw eliminated.

- One particular bird had been hard to both on the takeoff and in flight, because of a the right, despite repeated riggings of nose steering and control systems. Then it was (from a rear-end view) that while the rudd rigged to zero, the vertical stabilizer drag chute fillet assembly was about 2½ inches to the right. this displacement (caused by a swinging drag cable) was corrected, the yaw disappeared.

Other reports go briefly like this:

- "Takeoff trim off — right wing fence off
- "Ball to right at takeoff trim — wing bowed."
- "Noticeable pull to left — left wing tank off line."



THE YAW MAKERS

Reprinted from North American Aviation Operation & Service News

- "Subsequent inspection revealed splitter rudder bent at the trailing edge."
- "Rudder warped."
- "Flies ¼-ball left at 300 knots. Right-hand aileron segments out of tolerance."

Some yaw makers are not as readily apparent or as easy to spot, and some must be found the hard way. Take these:

- "Noticeable yaw on takeoff. Tests show right-hand gear retracts much faster than left." Cleaning hydraulic flow restrictors corrected the yaw in this case.
- "Afterburner on, nose left; afterburner off, nose right. Nozzle segments found hanging up and improperly aligned — situation corrected, yaw eliminated."

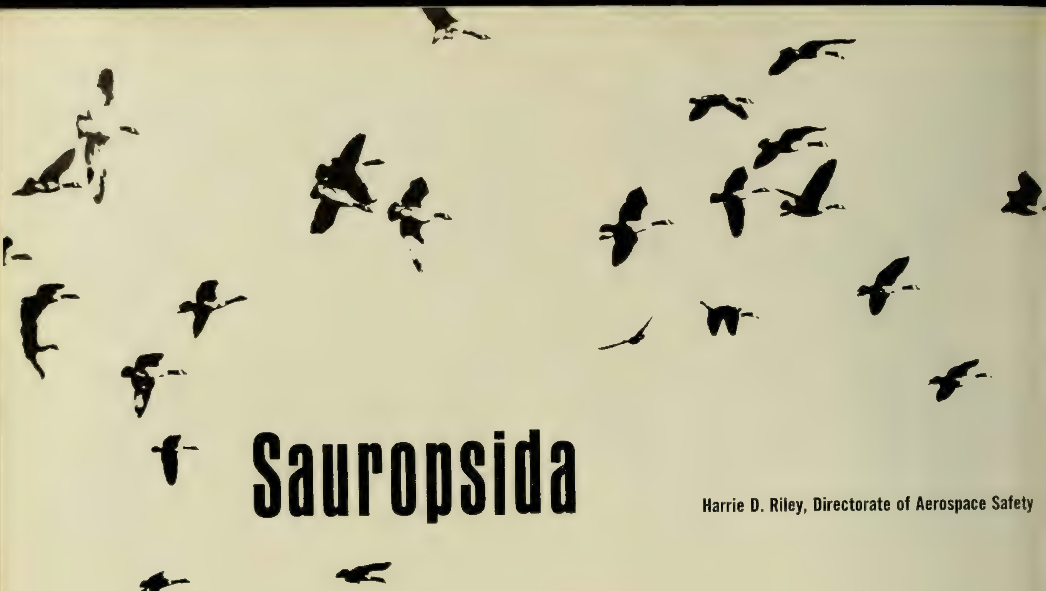
Here are a few other yaw makers to be on the lookout for:

- Hung slat
- Misaligned engine
- Warped flap, aileron, stabilizer, or wing tip.

At one base, the pilot had a yaw problem where there really was no yaw at all. It seems that after all possible sources of yaw were exhausted, the turn-and-slip indicator was replaced and the plane flew "straight" ever after.

Our pilots like to fly those birds, and rather than abort another mission, they will learn to live (sometimes dangerously) with yaw. Let's help them live without it. Remember, when a swept-wing airplane reaches a high angle of attack, near the stall point, a spin is only a yaw away. ★

THE YAW MAKERS



Sauropsida

Harrie D. Riley, Directorate of Aerospace Safety

Larus, buteo, sturnus vulgaris, and tardue merula are sauropsida. No, this is not double talk gobbledygook. It is just about the birds. Not for them, but against them — gulls, buzzards, blackbirds, starlings — all the feathered flock.

Usually everyone is interested in protecting the feathered friends, however, it appears that maybe they have been over-protected and now you as a pilot need the protection more. In fact, there are investigative programs afoot to try to eliminate the birds from the airfield and to give pilots better protection from them in the air.

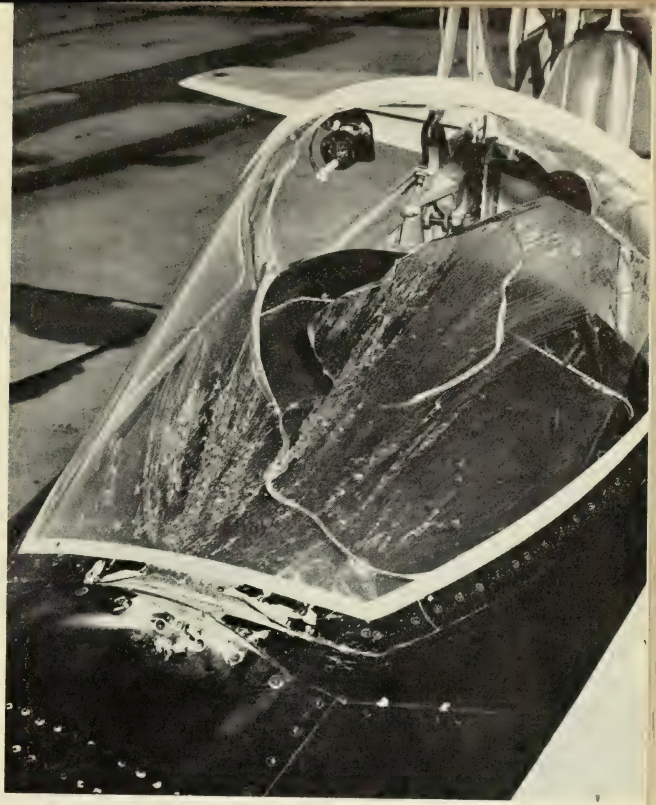
Last year the USAF experienced 145 reported bird strikes. This was a 107 per cent increase over the number reported for the previous year. Partially this was due to one or more of the major commands placing increased emphasis on reporting of bird strikes in the latter part of the year.

The most tragic bird/aircraft collision resulted in a pilot fatality and a destroyed aircraft. This occurred when the aircraft, breaking out from an initial approach, collided with a snow goose. The goose entered the rear left side of the front canopy. Subsequent pilot disorientation and loss of engine power resulted. Ejection was at too low an altitude for survival. Three other incidents resulted in minor injuries to air crew.

Engines and wings were the components most often involved in the bird strikes. Engines ingested birds in 55 incidents, necessitating replacement of 42 engines, because of internal damage. The wings, although involved in numerous incidents, usually only sustained dents and occasionally tearing of the skin. No fatalities or major accidents resulted from bird strikes on engines or wings.

The birds were the kindest to the bomber fleet. Only 14 cases of bird strikes against bombers were reported. Trainers had the most strikes (61). Most of these occurred in the southern half of the country where there is a heavy concentration of training bases. T-38 pilots have been experiencing numerous bird strikes; speed and relative quietness of engines of this aircraft are considered to be contributing factors. Strikes were so numerous at one ATC base that state and federal ornithologists were called in in an effort to try and reduce the hazard. The only solution seemed to be to stop flight operations during the early morning and late afternoon hours. This was not an acceptable solution to the commander.

Most collisions with birds occurred below 3000 feet and over a



This is what happened when a 3-lb duck and the windshield of a T-38 collided. Bird did not enter cockpit, but residue was found on student pilot's visor, which was down.

mile from the runway. Thirty-three incidents occurred during low level missions, including gunnery practice. Fifty-five occurred less than one mile from the airfield, with 18 actually on the airfield.

These are the statistics. Now what's the answer.

The answer lies mostly in the research effort being done in several countries. In the United States, the FAA and the Department of Interior are the principal investigative agencies working toward reducing or solving the problem. Governmental agencies in Canada, England, Holland and other nations are doing likewise. Our Bureau of Fisheries and Wildlife has been conducting research programs on bird habits, migration and methods of minimizing or eliminating birds in the vicinity of airfields.

Engineers at FAA NAFEC are studying effects of bird strikes on airframes and engines. These investigative programs will require considerable time and money. Increase in strength of windscreen materials and improvements in some turboprop engines by simple changes in the engine ignition circuits that provide engine recovery after bird ingestion are indicated in test results to date.

Around airfields the three most effective bird hazard deterrents are (1) denial of food, water and roosting areas (this is known as creating a biological desert), (2) clearing and gravel-surfacing airfield areas not immediately adjacent to airfield pavement, and (3) scare device programs using recorded bird distress and enemy calls, carbide explosives, etc. Distress and enemy calls have limitations since the many species of birds require different recordings. Destruction or scaring of birds is not a true solution since this is only temporarily effective due to constant bird migration. The real solution is to make the airport unattractive to bird life.

To help the pilot in flight the FAA has on occasion issued advisories concerning migratory flights of whistling swans, geese and other massive formations of birds. You may help yourself by wearing your helmet with visor extended. In attempting to avoid a collision with birds, the best maneuver is a climbing one. It seems that the bird's reaction is always to dive when attempting to avoid a collision. They use gravity to aid in their escape mechanism.

During the first two months this year 87 reports were received. This is 80 per cent of the number reported for the entire previous year. This points toward a probability of 500 or more reports for 1965.

This year, 1965, the Director of Aerospace Safety, in order to get a more valid picture of the potential hazard to aircraft from bird strikes, has requested that all bird strikes against USAF aircraft be reported, regardless of any damage. The information obtained will be fed into the bird research hopper to help in the national investigation program. ★

TREK WEST

SSgt J. T. Lambert, 1607 Air Transport Wing (MATS), Dover AFB, Delaware

Last winter 180 MATS families moved from Dover to McChord. A transfer of this sort is not without precedent, but the significant thing is that the move was made without accident. This may be due to luck, but luck is a very tenuous thing to depend on, so those in charge of the move turned to the more substantial process of providing concrete assistance to the families making the trek west.

The big concern was the trip by automobile across the country from Maryland to Tacoma, Wash., during the dead of winter when driving conditions would be at their worst. With this in mind, the planners devised a three-point effort to prevent accidents.

- Every family was briefed on what to expect as to weather, road hazards and routes.
- Three recommended routes were laid out and supplied to each family.
- A handout was distributed which contained a winter car care checklist and tips for bad weather driving.

Many Air Force families are on the move during every month of the year. For those who may be facing a long trip this winter, AEROSPACE SAFETY presents an extract from a briefing presented by SSgt J. T. Lambert of Dover AFB, Del., to the McChord bound families. The points he makes are valid and are recommended reading for anyone who drives during the winter, regardless of the length of the trip.

My goal today is to help you get to your destination in one piece. Toward that end, here are some suggestions.

Have you ever been blinded by the lights of an oncoming auto? When you passed the car you discovered that the driver wasn't really what you'd called him but another Air Force family on the move, with the car top carrier loaded and the back springs compressed. It might save your life to spend a dollar and a half to have your lights adjusted before leaving and after loading your car. The lives endangered are not only those in the approaching car but also your own, if the lights are in a blinding condition.

And now consider road traction on ice. When is ice slickest? Why do you have good traction in the early morn and very little by 10 o'clock. Traction on ice is affected by temperature. To give you an idea of the effect, consider a car at 20 mph with regular tires. At zero degrees it would take 110 feet to stop; at 20 degrees 200 feet; at 30 degrees 250 feet. Compare road traction to an ice cube at a cocktail party. When you first take an ice cube out of the freezer it is very easy to hold, easy to control. But after it has been in a drink, have you ever tried to lift the ice cube out? You'll find it's almost impossible to hold on to. It's really slick. That ice cube has had a temperature rise to near the freezing point. Traction loss on ice does make sense, doesn't it?

And now while at a party, let's consider another thought. Before leaving we know there will be many farewell parties. Please don't make the party a practice for a wake. Get a good night's rest prior to leaving. Fatigue does accumulate. It builds up and once you have started on your trip you'll find it's hard to overcome. It might even

pay to go 10 to 20 miles down the road to let your friends know that you're out of town and can't be reached. If the party was too rough the night before, stop there to rest.

On the road there are certain treacherous times that should be considered. It's a good idea to drive as if the car in front of you were a police car. Did you know that most injury accidents occur between four and five in the afternoon? And that most fatalities occur between one and six in the morning?

What is the most treacherous period during a rain? You'll find the first five minutes, before the water has had a chance to wash the accumulation of tar, grease and mud off the pavement, is the most treacherous period.

Snow is at its worst when the temperature is just above the freezing point — when it starts to melt.

Here's one that might surprise you: Did you know that nine out of ten fatal accidents and four out of five injury accidents occur during clear weather? Seven out of ten fatalities occur on dry roads. These treacherous times will give you some indication of periods to watch and prove that you must stay alert to arrive at your destination even in good weather.

You might plan your meal between four and five in the afternoon to stay out of the heavy traffic when people are on their way home from the office, rather irritated.

A good time to sleep is during the normal sleep hours. Be off the highways from one to six a.m., when you're tired and when your body ebb reaches its lowest point.

During rains be particularly careful during the first part of the rain.

If you leave in the early morning and snow and ice are on the ground, check your traction occasionally; test your brakes to be sure you still have traction, and to know how much traction you have at that moment.

Stay awake — stay alert during clear weather and don't think that clear roads mean a guarantee of safety.

I understand that in America there are two classes of travel: "First Class" and "With Children." We realize that children can frequently be somewhat annoying while on a trip. Have you thought of putting the children in the back seat and using seat belts? This keeps them in one place. And in case of an accident, the children are away from the dashboard and "little knobs" that make "little holes" in the "little heads." You do have your seat belts installed? Don't be found dead sitting on them! Use them!

Another thought for your safety: How about spending a dollar for flares, in case of a breakdown? This is a small price to pay for the safety they give you in the event your car stalls. Annually many Air Force people are injured because they are struck while trying to repair a car along the side of the highway.

Put a dime in your wallet. Then you'll always have telephone money for an emergency in a remote location if there's a pay phone available.

I have tried to give some facts and suggestions for you to consider. I hope that you will think about and use them. I would like to leave you with this thought: If you drive as well as you are capable of driving, you don't have to worry about this trip. ★

Missilanea

HEAVY HANDS – A rash of arm/disarm switch failures have occurred during the past few months throughout the Minuteman fleet. Careful analysis of the reported failures by OOAMA specialists has revealed that the failures were induced by faulty techniques or procedures being used by missile personnel. In each case, excessive pressure or torque during insertion or removal of the safing pin was the cause of the reported failure.

All personnel involved with the removal of the safing pin in arm/disarm switches must be advised that TO 21M-LGM30A-210, pages 4-12, 4-13, paragraph M, Steps 1 through 7, must be followed. These procedures are mandatory in order to preclude future damage to these sensitive switches.

Lt Col R. S. Kane
Directorate of Aerospace Safety

IMPROPER CONNECTION – The AGM-28A was in station for a guidance verification check. Electrical cables were connected and power applied to the missile. Smoke was observed around the forward compartment "I" beam, and all power was immediately removed from the missile. Investigation revealed pins v and x were shorted at the ground power receptacle M14J1. This caused burned wiring in the forward equipment compartment.

The primary cause of this incident was a worn keyway in the M14J1 ground power receptacle, which allowed an improper connection of the electrical cable to the receptacle. Extreme care must be exercised in the connection of the C2-34A-9 ground power cable.

As a result of this, and numerous other mishaps caused by improper alignment of the ground power cable, the ground power receptacle M14J1 and the mating plug on the ground power cable C2-34A-9 are being replaced with a newly designed, ruggedized, five key-way receptacle and mating plug.

BENT PROBE. A B-52 with two AGM-28Bs mounted under the wings was standing in alert configuration. Suddenly a COCO alert was called and the security guard went to the assistance of maintenance personnel in aircraft preparation. Removing the probe cover, the guard exerted too much downward pressure, bending the probe. This action caused the loss of one each Hound Dog until such time as the probe could be replaced! Another mishap attributed to personnel error caused by improperly trained personnel working around the missile.

If guards and other types of nonmaintenance personnel must be employed in the preparation of aircraft for an exercise, a suitable training program must be instituted. This is particularly necessary during winter months when engine covers, plugs, and heaters must be used extensively.

Maj E. D. Jenkins
Directorate of Aerospace Safety

MGM-13A. A missile was being returned to ready status following an engine run. As the hydraulic return squib firing cable was being connected, the two return squibs detonated. Fortunately, there were no injuries and damage was limited to squib expenditures. The most probable cause of this incident was tech data deficiency which allowed a 28 VDC circuit breaker on the selector control panel to be on during cable connection and provide a possible source of 28 VDC. Action is being taken by WRAMA to insert cautions in applicable tech orders which insure the 28 VDC circuit breaker remains off during connection of all squib firing cables.

Capt R. A. Boese
Directorate of Aerospace Safety

CORRECTION

Some lines of copy were inadvertently omitted from the item titled "Arm! Disarm!" on the Missilanea page in the September issue (page 20). The third paragraph should read as follows:

To remove the safing pin in the style B switch, first, engage the special wrench per Technical Order 21M-LGM30A-2-10; second, carefully but firmly push the safing pin straight into the missile until a definite stop is reached; third, release the pressure on th safing pin allowing the pin to back-off of its own accord (about an eighth of an inch); fourth, rotate safing pin slowly counterclockwise until a stop is reached; and fifth, pull safing pin straight out.

MEN TO COUNT ON

Major Thomas J. Slaybaugh, Hq USAFE

It was quiet in the blast lock area of the Titan II complex. Airman Randall was eating an apple and his buddy, Airman Zabronski idly stirred a cup of coffee. Between them, on the small table, were scraps of wax paper flecked with crumbs from the sandwiches they had eaten. The faint humming and soft rushing-air sounds of the air conditioning system were too familiar to be disturbing.

Lunch had been late today, by about an hour, because of a maintenance task deep in one of the silos. They had been making a routine walk-through inspection, Randall carrying the checklist, when Zabronski stopped, listening, head cocked to one side, senses alert, then asked Randall, "You smell something?"

Randall sniffed, noted a slight irritation. "Yeah . . . yeah, sure do."

"N_2O_4," Zabronski said. "Better get the PVD — its right over here."

They walked over to where the portable vapor detector had been placed and carried it back to the spot where they had noted the odor. Zabronski held the probe out and checked the dial. The needle quivered. They moved nearer the bird and Randall said, pointing, "Over there, I think. Looks like a very fine brown mist."

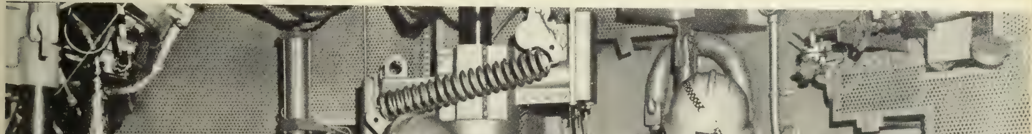
"Yeah." They moved over. "Stronger here," Zabronski added. "Five parts per million now."

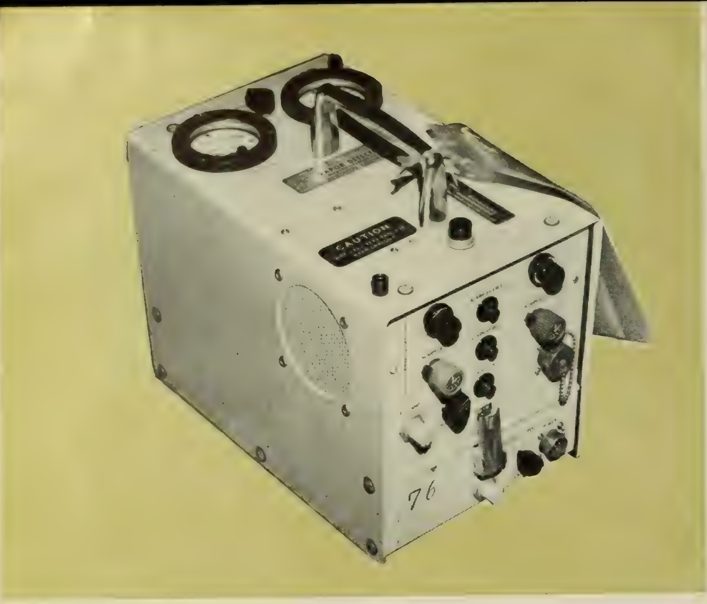
"Looks like it's around that joint —we better call it in."

They left the area, located a jack box, plugged into the comm circuit and called the MCCC. They gave their report and suggested that a RFHCO (Rocket Fuel Handlers Clothing Outfit) team be called from the MAMS. The maintenance officer, who was at another site at the time, also was called.

Within 30 minutes the RFHCO team and the maintenance officer had arrived.

Randall and Zabronski had briefed the maintenance officer, a captain, while the three of them donned extra RFHCO suits. They





went through the tech data and, from a diagram, indicated the area of the leak. The captain called production control, identified the joint and obtained the seal stock number.

Together with the RFHCO team, the three of them went to the silo, checked the leak with the PVD and consulted the tech data. Instructions were detailed. For maintenance, valves to be closed were identified. The three cross-checked, then Randall turned the specific valve clockwise until it seated. They checked the leak again.

"Stopped now," Randall said, after moving the PVD probe around the flange and noting no indication on the needle.

"Right," the captain agreed. He looked at Zabronski. "Where'd you put the new seal."

"I'll get it." Zabronski went over to a small table, picked up a plastic bag with the seal in it, came back and opened the bag.

The captain opened the bag, examined the seal, handed it to Zabronski and looked up at a pressure gage. It's pointer was steady on zero. "O.K.," he said to Randall. "Let's open it up."

Randall fitted a wrench to one of the flange bolts and began loosening it. When he had the bolts out he pulled the line apart and the captain removed the old seal. He turned it slowly until he noticed a wrinkle across it. "There's our trouble," he said, "seal had a crimp in it; pressure finally worked through and she began to leak." He picked up the new seal, turned it over, examined it carefully, then handed it to Zabronski. He said to Randall. "See if you can spread those pipes until I check for remains of the old seal or contamination." He examined the joint carefully, using his flashlight, then nodded, "O.K., Zabronski, let's put the new one in."

Zabronski fitted the new seal in place and, while the captain watched, Randall fitted the two ends of the pipes together. He reinstalled the bolts through the flange holes and drew them tight. Again the captain examined the joint, then said, "Open the valve, slowly." Randall walked over to the valve and began opening it. "Keep that PVD handy," the captain said to Zabronski, then looked up at the pressure valve. "Pressure's coming up — hold it there, Randall, until we can check it." Zabronski moved the PVD probe completely around the joint. The needle didn't move. "O.K., looks like we have it. Open the valve all the way." Randall opened the valve. "Check it again," the captain said. Randall came over to watch as Zabronski probed with the PVD. "Good," the captain said, "be sure and put it in your report." The two airmen nodded.

The captain called the MCCC, reported work completed and noted the time.

Now, relaxing after lunch, Randall looked at his fellow technician and said, "Zab, this is quite an operation, when you think about it. We found a simple little old leak — replaced a seal and it's fixed. But, we had to get the books out, have a supervisor on hand — really make a production out of it."

Zabronski sipped his coffee, thinking of what Randall had said. This was a way of life that, as a missile technician, had become second nature to him. He didn't think about it much anymore; just performed each task, methodically, exactly as tech data prescribed. But now, in response to Randall's comment, he ventured an analysis. "You're right, but I understand why we have to do everything by the book. The leak occurred because someone failed to do a simple task properly. No harm was done. We found the leak, put in a new seal and made sure the leak has been fixed." He drank the last of his coffee and began to scrape the crumbs onto a piece of wax paper. "Remember that safety magazine article about the investigation of a fire that destroyed a silo and a missile — I think it was an Atlas? The most probable cause, according to the article, was ignition of a fuel spill by a spark from an electric pump. The fire had been fed by LOX. You know, the first step in the sequence that blew up that hole might have been some little thing like a crimped gasket."

"Yeah," Randall sat, thinking. Then, glancing at the clock, "Say, we better get with it. We're five minutes late for our 1430 inspection. And we've got to finish in time to make out our report on that leak." ★

TWO STRIKES..THREE, YOUR'E OUT!

Lt Col Ray C. Gordon, Directorate of Aerospace Safety

Weather for that time of the year was typical — thunderstorms, wind, rain and low ceilings. The T-33 pilot, enroute to a midwest base, was approaching his last reporting point, when, at 37,000 feet in the soup, smoke started coming into the cockpit. All instruments checked normal with no indication of a malfunction. But white smoke was still entering the cockpit. Then he saw a wisp of white vapor coming out of the battery vent in the nose. Off with the mask. Check for the odor. Sure enough, electrical smoke.

The pilot informed Center of the emergency, requested an enroute descent and asked Center to alert the base. Meanwhile he was taking precautions to reduce all unnecessary loads on the electrical system. Descent was begun. Approximately eight miles out on GCA final the situation appeared to be getting worse — more smoke in the cockpit, moisture from the vent on the windscreen. Still in the soup and approaching glide path. Finally, at about 800 feet, he could see the runway and the fire equipment waiting. He breathed a sigh of relief. The landing was made without further problems.

After engine shutdown, the pilot and the fire chief opened the nose, taking proper precautions because of the heat and possibility that an explosion might still occur. The

Culprit! Voltage regulators were involved in 12,600 malfunctions and nearly 500 aborts during a six-month period last year.

sight that confronted them when the smoke cleared was: one battery melted in half and the top of the other one melted away. Electrolyte covered the nose and canopy. After maintenance it was determined that the voltage regulator had fouled up. A near miss — *strike one.*

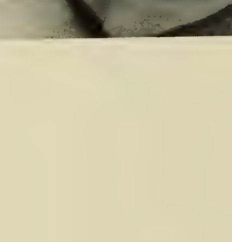
A few weeks later, the same pilot in another T-33 had departed a southern base and leveled off at 33,000 feet, again in weather. Suddenly the generator light came on. He checked the instruments and cut off the non-essential electrical equipment. The center was notified of the situation and an emergency was declared.

Now a decision was necessary; should he return to the base of departure, where the weather was broken to overcast at 3500 feet and visibility about three miles, or should he find a closer base? To return would mean retracing the route for approximately 160 nautical miles. Realizing that, at the worst, there should be time to make a few radio calls, the pilot asked Center for the location of the nearest airfield, and the existing weather. Center supplied this information and the pilot decided to go the 60 nautical miles to this field. Center was requested to approve an enroute descent and also informed that the aircraft radio would be off for five minutes. Weather now was 1500 feet overcast, 2½ miles visibility. Descent was started , radio again activated and a hand-off to GCA accomplished without incident. The pilot made visual contact with the ground immediately after intercepting the glide path and sighted the runway at about two miles. An after-landing check revealed that the voltage regulator had malfunctioned. Another near miss, *STRIKE TWO.*

These two mishaps occurred within a few weeks of each othe and neither found its way into *UR's* or incident reports. Why? How many others are occurring and not being reported? What does a voltage regulator malfunction cost the Air Force in accidents and incidents? The pilot with the tw strikes on him did not want t strike out, so he got curious an started checking into the answers t these questions and some others Here are some of the facts he uncovered:

During the past three years there have been 26 voltage regulators reported on UR's, 34 incidents 1 minor and 1 major accident wher the voltage regulator was involved During a six month period in 1964 66-1 data for all aircraft showed total of over 12,600 malfunction and almost 500 aborts where th voltage regulator was involve This is quite a difference and brings to light a problem tha should interest all pilots: Pilots ar not reporting or causing this discrepancy to be reported so that th personnel responsible for analys of such problems can take the necessary action.

One thing for sure — the ne time the pilot with two strikes o him gets up to the plate, he wi help insure that he gets a home ru by reporting malfunctions of th kind. HOW ABOUT YOU? D YOU WANT TO STRIKE OUT?



In the past three years, voltage regulators have been UR'ed only 26 times. Better reporting is necessary.

Aerobits

FREQ CHANGE — Pilots of VHF equipped aircraft should take note of a frequency change that will go into effect October 14. At that time, 135.9—the frequency assigned for communication with flight service stations—will be changed to 123.6.

This will be of particular interest to Aero Clubs, since most of their aircraft are VHF equipped.

HINDSIDE-BEFORE — In the old-style comedies when someone accidentally set off a fire extinguisher and doused everyone with a harmless powder, it was funny. But there weren't any laughs in the cabin of a U-3 when the copilot hit the fire extinguisher with his left heel and it discharged in the cockpit. Yes, somebody installed the extinguisher bracket backwards. When this bracket is properly installed it is virtually impossible to discharge the extinguisher. That's the way it was intended to be, so why try to improve on it?

MURPHY AGAIN — Pilots supposedly have 20/20 vision (possibly with a little help), but this doesn't guarantee that they will always see what they're looking at. Case in point: After a pilot reported smoke coming from the left side of the cockpit of a T-38, a check revealed the engine start ignition circuit breaker panel installed backwards. As a result, the turnbuckle on the left throttle cable had rubbed against the C/B wiring harness until a short circuit occurred. The throttle cable was burned apart and several wires in the harness were shorted. This panel had been removed during other maintenance and nearly 40 flights had been made since then without a pilot's noticing the panel was installed backwards. The base where this occurred placed alignment marks on all panels to prevent recurrence and recommended that the panels be modified so that improper installation would be impossible.

UNMANNED MENACE. The pilot (?) of a light aircraft discovered his battery was dead so he crawled out and attempted to prop the bird by hand. He was successful — there was no one in the cockpit, the brakes weren't set and the aircraft did just what it was built to do. The man jumped out of the way and grabbed a wing strut but he couldn't hold the beast which promptly chewed up two aircraft parked nearby. One of them was an aero club T-34 that was at the airport for maintenance.

In this case no one in the aero club was to blame. We simply mention it here because this sort of thing happened three or four times last year with aero club members being the guilty parties. Therefore we reiterate: never, NEVER, prop an aircraft for starting unless a pilot qualified in that type aircraft is in the pilot's seat, the aircraft is chocked and the brakes are set. (See AFM 215-4, Attachment 3, Part VIII, Section 2.e.)

Aerobits

ONE PIN FOR A T-37 – The pilot was showing the crew chief the pins when one dropped and was ingested into the left engine. The engine was immediately shut down, but damage had been done.

REVERSED LEADS – During takeoff on a functional check flight following PE the aircraft began yawing right and left at about 140 knots. The yaw stab aug was turned off and control was normal. After the pilot leveled the T-38 at flight level 410, point nine mach, one "G" flight, the left engine flamed out. A normal restart was made at FL 300, 240 KIAS. The engine flamed out again at FL 300 and was restarted. Subsequently flameouts were experienced at FL 200 and at 15,000 feet. Normal restarts were made. After the last restart the left engine was left in idle and the aircraft landed. Investigation revealed that the phase A and B leads to the left generator had been reversed during the PE and this reversal caused the left fuel boost pump to run backwards and the input to the yaw stability augmenter was out of phase, causing it to malfunction. Probing further, investigators found that there had been several reports of electrical malfunctions which affected certain systems but did not cause the respective generator to go off the line. In this case, if the left generator had been turned off, the yaw augmenter and the left boost pump would have operated properly off the right generator. However, had some failure in the right system caused the electrical load to shift to the left generator all three phase systems would have operated in reverse.

LOSS OF RUDDER MOVEMENT – The following incident was related in an OHR that was submitted by the flight mechanic who was part of the crew that experienced the incident.

While cruising at 10,000 feet with a free air temperature of -20° C. and with an aircraft anti-icing temperature of 100° C. the pilot of a C-123B reported loss of rudder movement. Flight mechanics checked all accessible parts of the rudder and could find no cause. The anti-icing ducts in the tail section were all hot and there was no ice on the outside of the aircraft. The rudder gust lock was in the release position. The flight crew decided there had been water in the tail section before takeoff and that it had frozen around the rudder torque tube. The crew chief removed the cargo compartment heater ducts from the side of the aircraft and connected them to the left horizontal stabilizer anti-icing duct so he could get heat to the bottom rudder support bearing. After about 20 minutes with heat in the tail cone, the rudder started working normally. Afte the aircraft landed the rudder system was inspected, and nothing was foun that could cause the rudder to bind There was indication that water had accumulated on the rudder bell crank in a position where it could run down in the lower bearing. There is a recess in the lower bearing that could collect wate and freeze.

The OHR has been forwarded throug channels for consideration of a possibl fix through the drilling of a drain hole.

Maj John J. O'Connor
Base Director of Safety
825 CSGp(SAC) Little Roc
AFB, Arkansas

HOT PILOT – The F-100 jock was understandably annoyed. First, he reported to fly only to be delayed an hour while some maintenance was being done on the aircraft. Then, because of heavy traffic, he had to wait 30 minutes for takeoff clearance. By this time he was mad at the world. While he was sitting on the ramp he was on 100 per cent oxygen; at 10,000 feet he switched the regulator to normal. A few minutes later, with cockpit pressure at 12,500, he began to notice the same symptoms of hypoxia that he had experienced in the pressure chamber – blurring of peripheral vision woozy sensation and tingling of hands and feet. He went to 100 per cent, checked the blinker and O_2 quantity both of which appeared okay. He started descending and headed toward home, and within a few minutes began to feel better. After he got on the ground he was taken to the flight surgeon where he was checked over and found to be shipshape. The PE troops examined his mask and found it to be okay, and a thorough check of the aircraft oxygen system failed to turn up anything.

The medics finally concluded that this pilot was hyperventilated due to his emotional state during the first part of the flight, and that when he switched to 100 per cent he probably also controlled his breathing which corrected his condition.

QUALITY CONTROL is a much belabored subject, but deservedly so when one considers such occurrences as the following:

During climbout the IP discovered that the elevator trim worked in reverse, so he made a precautionary landing and took the bird into the shop for repairs. Seems that after the previous flight a runaway nosedown trim was reported and the trim actuator was changed, inspected and the aircraft, a T-37, was released for flight. Now the trim worked in reverse. Why? Maintenance personnel dug into the system to find out and noted that the trim actuator leads on terminal strip Nr 1 were reversed. Then the old actuator was checked and found to work in reverse. Apparently when it was installed at another base the leads must have been reversed. No maintenance since then had been performed on the actuator.

Granted that there was a goof where the old actuator had been overhauled, the reversed condition should have been detected, 1) during installation of the new actuator, 2) during inspection of this installation. Another Murph compounded by carelessness!

HORSE SENSE IN THE JET AGE? –Maybe we should entitle this "Lack of Common Sense."

In two recent incidents the pilots were informed by ground observers that their aircraft were shedding parts. One was on the gunnery range; the other was taking off on a cross-country. In neither instance did the pilot investigate to determine the extent of the discrepancy; however, the pilots did report that all instrument readings were normal. How about that! Since when have we had sensors and instruments that reflect the condition of the entire aircraft?

Maybe I'm a coward, but upon receiving such news I would start thinking in terms of getting the machine and yours truly safely on the ground – but fast.

I would not continue to make gunnery passes and neither would I proceed on a cross-country flight.

Faulty reasoning? Possibly, but we have the best engineers design our aircraft and I accept their judgment that only those bits and pieces are used that are necessary for an aircraft to accomplish its mission. Consequently, when things start falling off, you are short already!

Why try to do the job with part of an aircraft? The job you do may be your last.

Lt Col Harold K. Boutwell
Directorate of Aerospace Safety

Aerobits

BENT TRIGGER — If this mishap had occurred a minute or two sooner we might have had to label it BENT PILOT. Just before the F-105F turned off the runway, the front cockpit pilot's lap belt initiator fired, releasing the belt and firing the seat-man separator. This pushed the pilot against the canopy. After the aircraft cleared the runway and was shut down, a check revealed that the lap belt initiator trigger was bent just aft of the attachment point to the activator link. This permitted the trigger latch to work its way under the bottom of the track. With the trigger in this position, the motion of the aircraft caused the trigger to fire the initiator.

The only answer that could be found for this condition was that at some time a foreign object — tool bag, clipboard, etc., — had been placed behind the seat. This could have bound the linkage so that it would have been bent when the seat was raised electrically.

A few days later, during a 50-hour inspection, a similar condition was found in the rear seat of another aircraft. This led to a 100 per cent inspection of all the other '105s at this base and one more was found. Recommendation was that all F-105 wings perform a similar inspection.

ICED T-39 — There is plenty of cold weather ahead, and one of the things to watch for is the formation of ice. This occurred on a T-39A aircraft in the following manner:

An out-and-back flight was planned for a T-39, with a stop at the far end. Since it was only about an hour each way, there was no need to take on more fuel. It was freezing at the base of departure, and the short flight at altitude was all that was needed to coldsoak the fuel. It was night when the T-39 landed to discharge a passenger. The weather at this time was not critical; however, a bitter cold drizzling rain was falling — nearly at freezing temperature.

The pilot taxied in, shut down one engine, let out the passenger, and prepared to continue. As a safety precaution, however, the pilot decided to take a close look at the wing. Although there was no indication of ice on the windscreen or nose section, the wings glistened as if there were a sheet of ice on them. Closer inspection revealed this to be ice.

As the near-freezing rain fell on the wing, it immediately froze. In the few minutes that the aircraft had been on the ground, a heavy coat of ice formed on the top of the wing. Needless to say, plans for an immediate take off were canceled.

The base originating this report attributed the formation of ice on the top of the wing to the fact that the wing had been cold-soaked by the wing fuel during flight. However, depending on the amount of fuel in the wing, ice may or may not be indicated on the wing upper skin over the fuel tank and not at all on the wing leading edges. Yet there could be a large build-up of ice on the wing lower surface. This condition could continue even after the airplane had been on the ground in above-freezing temperatures because of the cold-soaked fuel which would always be in contact with the bottom of the wing skin. Therefore, the lower wing skin should always be checked for ice any time the airplane has descended from high altitude. ★

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North American Aviation, Inc.

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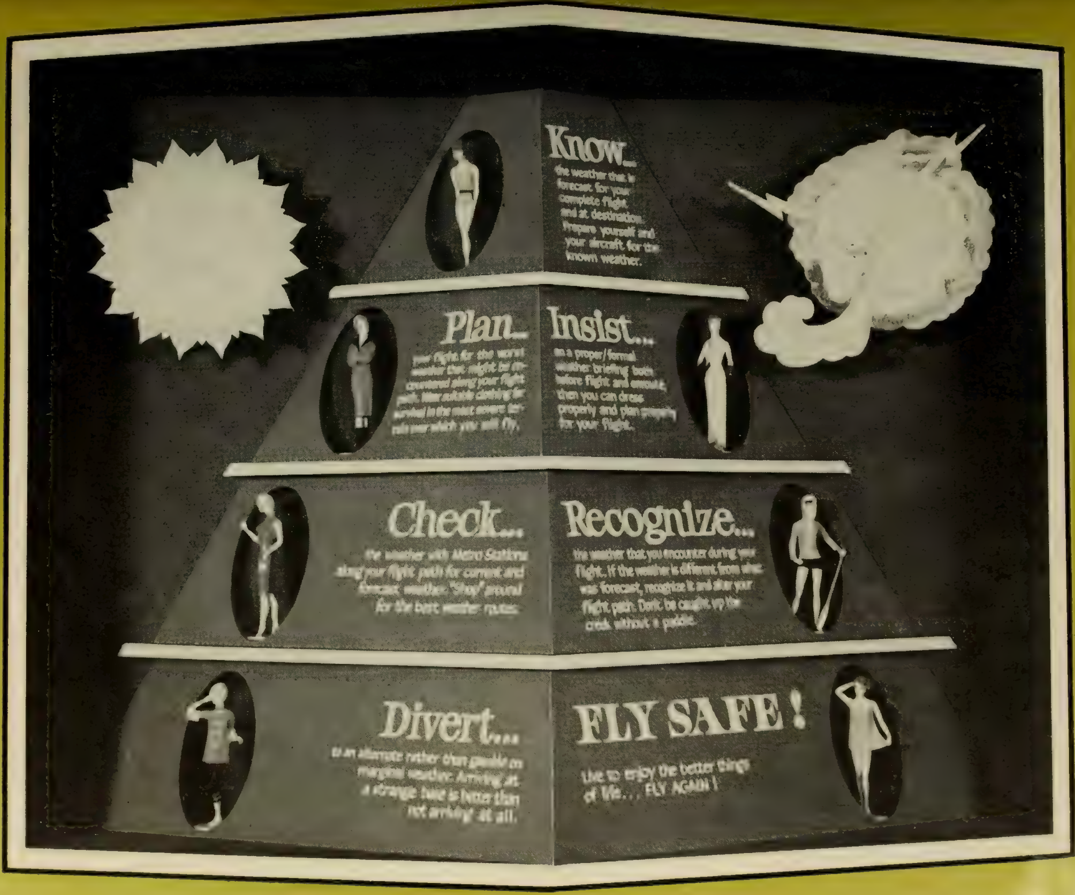
WELL DONE

CAPTAIN RICHARD P. MILLS

195 AIR TRANSPORT SQUADRON (H), VAN NUYS ANG BASE, CALIF

On 16 August, 1964, Captain Richard P. Mills was Aircraft Commander on an Air National Guard C-97 carrying 47 military passengers from Alameda, California, to Hurlburt AFB, Florida. Two hours from departure point and at 17,000 feet in weather over mountainous central Colorado, the aircraft was struck by lightning. A loud explosion followed and a crewmember reported fire trailing from the wing behind Nr 2 engine. Captain Mills immediately called for feathering of the engine, however, fire continued and an emergency descent was made with vectors from Denver Center to Grand Junction, Colorado, the nearest suitable airfield. Increased airflow extinguished the flames, however, the left flap was burned nearly in two, and a no flap emergency landing on 5400 feet of runway at 4850 elevation with heavy passenger and fuel load was imminent. Captain Mills executed a three-engine ILS and by careful airspeed control was able to touch down just over the threshold. With three engine reverse and maximum braking the aircraft was stopped within the available runway. His calm analysis of the emergency, inspiring complete crew coordination, avoided a disastrous crash which would have been fatal to 47 passengers and six crewmen. The superior skill of Captain Mills in successfully executing a no flap landing with 140-knot minimum touchdown speed on a short airfield saved the aircraft, crew and passengers. WELL DONE! ★



Know... the weather that is forecast for your complete flight and at destination. Prepare yourself and your aircraft for the known weather.

Plan... your flight for the worst weather that might be encountered along your flight path. Wear suitable clothing for survival in the most severe terrain over which you will fly.

Insist... on a proper/formal weather briefing both before flight and enroute; then you can dress properly and plan properly for your flight.

Check... the weather with Metro Stations along your flight path for current and forecast weather. "Shop" around for the best weather routes.

Recognize... the weather that you encounter during your flight. If the weather is different from what was forecast, recognize it and alter your flight path. Don't be caught up the creek without a paddle.

Divert... to an alternate rather than gamble on marginal weather. Arriving at a strange base is better than not arriving at all.

FLY SAFE!

Live to enjoy the better things of life... FLY AGAIN!

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AFRP 62-1 NOVEMBER 1965 VOLUME 21 NUMBER 11

FALLOUT

THE 45-DAY WONDER

Absolutely great — both cartoons and story! (July issue) Seems like a long time since we were able to laugh at ourselves. That trend could be our greatest danger.

Really — it was great!

Maj D. K. Jones
Director of Information
Hamilton AFB, Calif

Many thanks for your complimentary remarks. A skilled artist is an invaluable asset. Dave Baer is one of the best!

SEE-THRU CIGARETTE LIGHTERS

There have been several items and articles written recently concerning the hazards and potential fire problems involving the "See Thru Cigarette Lighters" which require rotation to obtain fuel for ignition (one reference, "Molotov Cocktails," August MATS Flyer).

Although this was a flying safety item previously, a check of our crews revealed that several were in possession of these lighters and not aware of their potential hazards.

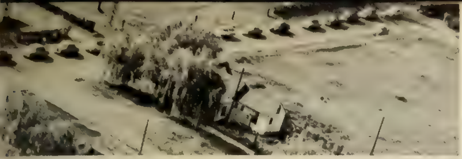
We are making this an item of local interest and plan to include a reference in our passenger briefings.

I recommend that you consider either removing this type of lighter from Exchange and Terminal facilities, or attach a removable tape specifying danger and restriction for use in aircraft.

Maj Challen P. Hunt
Chief, Safety Office
Griffis AFB, New York 13442

There has been a lot of publicity on the hazards of these cigarette lighters under reduced atmospheric conditions, such as encountered in flight. Nevertheless, we still hear about incidents involving these lighters. The kind Major Hunt refers to has a fluid reservoir that supplies the wick. These are usually plastic and the owner can see how much fluid is left in the tank. The decreased pressure at altitude causes the fluid to leak and when the thing is lit, a handful of flame may result. This is bad enough in a transport, but imagine the plight of a fighter pilot if this should occur. Maybe the old fashioned match wasn't so bad after all!

Another possibly hazardous lighter has come to our attention. It's a non-rechargeable, throw-away butane lighter. Tests have shown that these leak at high altitude and when lit may throw an extremely long flame. The big danger, of course, is the normal reaction to immediately get rid of a hazard such as a ball of flame in your hand. Then look out!



A PMV REPORT

13th Air Force Accident Prevention Topics, 1965

How's the private motor vehicle accident picture? Improving, but still not good. The following, adapted from a numbered Air Force safety publication, does an outstanding job of analyzing their problem and offering recommendations for improvement.

Private motor vehicle accidents continue to be one of the major sources of military disabling injuries. Four-wheeled vehicles recorded the greatest increase in accidents during 1964 as compared with 1963. Factual as this is, operation of two-wheeled vehicles is considered to have the greatest accident potential since most all mishaps result in personal injury to the operator and/or passenger.

Strangely enough, analysis reveals that sub-standard roads, vehicle defects, inclement weather, restricted visibility, or hours of darkness had little or no direct relationship to the number of private motor vehicle accidents reported during 1964.

Excessive speed for conditions, failure to yield right of way and plain inattention on the part of the vehicle operator were the predominant primary causes of private motor vehicle mishaps. It was noted that in many instances, vehicle operators failed or were not coordinating driving ability with existing or developing road and traffic conditions. Particularly alarming was the large increase in the number of reportable accidents involving drinking and/or fatigue on the part of the operator.

If the upward trend in private motor vehicle accidents is to be halted, and it must, then commanders must personally insure that:

- The Motor Vehicle Traffic Supervision Program outlined in AFR 125-14, 20 Dec 1962, as supplemented is fully and impartially implemented.
- The two-wheeled motor vehicle controls are strictly adhered to.
- Safety personnel develop and publicize an educational "DEFENSIVE RIDING PROGRAM" so as to foster a sense of moral responsibility on the part of passengers to insure safe, prudent, operation of all vehicles by the operator. This program should supplement the defense driving program conducted as a part of the command motor vehicle accident prevention program.
- Sound corrective action is taken in the event of a vehicle mishap to minimize the possibility of a similar accident. Where warranted, consideration should be given to judicious use of disciplinary/administrative action.

It is not intended to infer that the foregoing recommendations will provide a panacea for all of our private vehicle accident problems; however, they will provide the basic ingredients for an organized approach to our problems. As a means of further emphasizing their personal interest in this area of accident prevention, commanders should consider requiring a personal letter of circumstances from each private motor vehicle (two and four wheeled) operator involved in an accident. The letter of circumstances could include all the facts surrounding the mishap, as well as specific actions the operator will take to preclude similar occurrences in the future. Such letters of circumstances could be forwarded to the commander concerned through command channels to assure that all supervisory personnel are aware of the mishap. ★

FUEL MANAGEMENT

EFFICIENT FUEL MANAGEMENT IS THE PILOT'S PROBLEM, BUT IT ALSO INVOLVES OTHERS: SUPERVISORS, MAINTENANCE PEOPLE, QC SPECIALISTS AND MANUFACTURERS OF THE TOOLS WHICH THE PILOT MUST USE TO PROPERLY DO HIS JOB.

Fuel is — or should be — one of the most vital considerations for pilots conducting any flight. More sweat has probably been expended over this one item than any other single thing in flying. This was true for the first military aircraft and, despite all the changes that have taken place, is just as true today.

With our sophisticated systems, highly trained pilots and wealth of facilities, it would seem that "running out of gas" shouldn't happen anymore. But it does. Fortunately, it is usually possible to pinpoint the cause factor and, consequently, to do something about preventing this from claiming any more of our crews and aircraft.

In analyzing the record for 1964 and the first four months of this year, it is apparent that there has been some heads-up piloting, weak supervision and some pretty poor information published in the hand books relative to fuel management. This adds up to the word *preventable* and that's what most of the accidents are that are labeled Pilot Factor—fuel mismanagement. There were 11 major accidents and five incidents under this label during the time period mentioned. There were seven ejections and eight aircraft totally destroyed. Worst of all there were three fatalities.

In four cases the aircraft crashed on final approach with the runway in sight. Two of these were fatal to the crew. Four of the pilots had to make deadstick landings, one of which ended in major damage to the aircraft.

Five commands were involved not including the ANG.

Usually it is possible to pin the primary cause factor of an accident. But this doesn't always mean that you can prevent future accidents of the same type by attacking the specific cause. Behind this cause there may be a complex of contributing factors that do not always lend themselves to easy analysis. For example, an accident investigation board might do a very thorough job and reach a conclusion that is rational, valid, and difficult to dis-prove. But if this same board should investigate a dozen similar accidents, it might begin to see a picture that goes beyond the immediate cause of the accidents.

In analyzing the major accidents in which fuel starvation induced by the pilot was determined to be the primary factor, we found that five out of 11 of these involved pilots who were either relatively inexperienced as pilots or new to the aircraft involved. This would appear to imply lack of familiarity with the aircraft performance or inadequate checkout procedures.

There was one clear-cut case, and the possibility of another, in which information in the Dash One was inadequate and, in fact, misleading.

Lack of, or faulty, supervision creeps in too often.

Now, to back up what we say, let's look at some of these accidents and incidents with an eye toward shedding a little more light on a problem that is as old as the airplane.

During an air-to-air dart mission, one member of the flight called that, due to bingo fuel, he was returning to base. The leader acknowledged, and although this was a relatively inexperienced pilot in this aircraft, he was not concerned because the aircraft should have had plenty of fuel to return safely. Short of the base and near Field X the pilot saw that he couldn't make it and announced that he would land at Field X. While maneuvering to enter the pattern his aircraft flamed out and he ejected — safely.

The primary cause of this accident was attributed to pilot factor, in that during descent the pilot inadvertently left the throttle in extended afterburner which resulted in rapid depletion of fuel and flameout.

While this pilot was new to this aircraft, the F-105F, he had a great deal of experience in the F-100 and was considered highly qualified in that bird. Why then would he make such a gross error in another type? The contributing factors point to the *Whys* behind the apparent cause. The F-105F extended afterburner stop was designed to operate in a movement opposite to that of other models of the F-105. It could therefore be inadvertently actuated to the "Extended" range by an inexperienced pilot, and there is no positive visual indication in the cockpit to indicate that the engine is operating in afterburner.

The Dash One was deficient in that to illustrate the throttle quadrant it contained a picture of the F-105D quadrant instead of that on the F model. (This was corrected in the new combined F-105-F-105D Dash One dated March 1965.) They're different. Also there was very limited information in the manual relative to afterburner operation and it was misleading as to the amount of thrust in extended afterburner compared with military power. Nor did the manual mention that the fuel quantity gages are accurate only in level, stable flight. There were other deficiencies in the manual.

F-101F

Two crewmembers were killed when an F-101F crashed short of the runway after running out of fuel. During an intercept mission an emergency was declared due to low fuel. The intercept director gave the pilot a choice of three fields at which to recover and the pilot chose the one with which he was familiar. Enroute, he passed one of the other fields, a 7500 foot municipal runway. Weather was clear with 50 miles visibility.

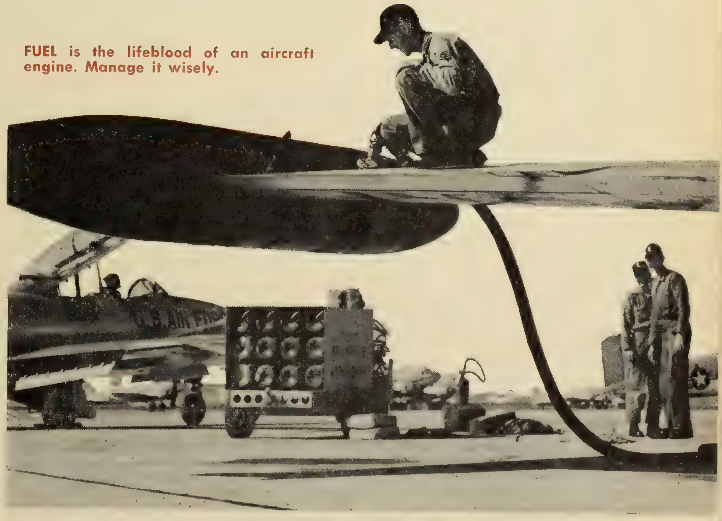
At 52 miles from his intended recovery base the pilot gave his fuel as 900 pounds. He repeated 900 pounds at 30 miles and again at 18 miles when he canceled IFR and said he had the field in sight.

The aircraft was cleared to land. As it approached the field the tower operator saw that it was lined up with the wrong runway so he advised the pilot to make a correction. He made the turn, which put him on a close downwind, then a tight left turn to base. During this turn he lost most of his altitude. As the pilot decreased the angle of bank the nose rose to an estimated 35-45 degree pitch angle and the aircraft struck the approach lights and crashed. Neither the pilot or the RO attempted to eject.

There was very little fire which indicated practically no fuel aboard. When the engines were examined during the accident investigation both were estimated to have been turning at about 5 to 20 per cent rpm.

This flight was briefed for the mission and recovery at the base where the crash occurred with normal fuel reserve. The aircraft should have landed with more than

FUEL is the lifeblood of an aircraft engine. Manage it wisely.



Eleven serious accidents in sixteen months due to fuel starvation indicates a se

500 pounds of fuel. Investigators concluded that the pilot failed to monitor fuel consumption during the supersonic phase of the intercept. However, indications were that there was sufficient fuel for the landing if, at the last minute, the pilot hadn't boxed himself into a corner by lining up with the wrong runway. This led to high thrust and consequently high fuel consumption at low altitude during the turns to line up with the runway, which exhausted what little fuel he had left. Prior to that he'd played it pretty cool by keeping his altitude until reaching an appropriate position for descent to the base. Hindsight being so good, however, we can see where if he'd held off the descent for a bit longer his fuel situation would have been better at termination and he might have been a little calmer during those last couple of minutes when he made the fatal error.

Whether experience had a bearing on this accident is hard to say. The pilot had jet experience then spent four years as a GCI controller during which time he flew the T-33 and U-3. He did not fly at all during the year preceding his assignment to 101s. Prior to this flight he had accumulated just under 60 hours in the bird, was considered combat ready but was not being used on five minute alert because of his low time in the F-101.

F-84F

This one concerns a highly experienced, highly qualified pilot who made some initial mistakes that caused a forced landing and who then became the victim of circumstances that led to a major accident.

The mission was a low altitude photo recon in an RF-84F out of a strange base. After about 45 minutes of flight, the wing and forward booster pumps pressure warning lights and the main tank low level warning light came on. The pilot checked the tanks and found that he had 1800 pounds in the external tanks and 1100 pounds in the main tank. Both wings and the forward tank indicated empty. This indicated that the external tanks had ceased to feed after transferring about 1000 pounds. This was the first fuel check the pilot had made since takeoff.

With the fuel in the external tanks unavailable, the pilot declared an emergency and asked for vectors to a pre-selected alternate field. As he approached the field, the engine was surging and fuel flow fluctuating. Although expecting an immediate flameout, he stayed with the bird and got it on the end of the runway, a 5000 foot strip with no barrier. He immediately got the nose down and pulled the drag chute handle but the chute did not deploy. Although the anti-skid appeared to be working, he was unable to stop and because of a built up area and highway straight ahead, he veered to the left off the runway. The nose gear collapsed and the aircraft received major damage.

Although there was materiel failure which caused the external tanks to not feed, the pilot failed to recognize this because he did not make any checks of his fuel until the warning lights came on. Despite his long experience in other aircraft, he had only 40 hours in the RF-84F. When faced with the emergency he suddenly found that the cockpit seemed completely foreign, indicating that he was somewhat less than intimately familiar with the aircraft.

Another pilot, not so fortunate, lost his life in a similar situation when he was unable to transfer fuel. The aircraft was an F-84 on a cross-country, when the pilot determined that he had a fuel problem, although he never stated the exact trouble. He crashed while trying to get to a base for an emergency landing ("Lucky 64," AEROSPACE SAFETY, August 1965).

F-100D

An F-100 pilot had to leap out during a night low level mission when the aircraft flamed out due to fuel starvation. Again, external tanks apparently were not feeding. The accident was laid on the pilot because:

- The drop tank empty light didn't come on, indicating that fuel was not feeding.
- These tanks should have been empty from the first check point of the second low level route.
- At this point, when the light did not illuminate, the pilot should have recognized the situation.

During these night missions which combine visual and instrument flight, cockpit lights are generally turned low to improve the pilot's outside vision. It's possible that, with the lights turned very low, the fuel gage needle can be misread. In this case it was theorized that the pilot, at a check point, may have been reading the wrong end of the needle, which was at 6000 pounds while the actual reading was 1000 pounds.

This aircraft had a history of fue system trouble, primarily the righ drop tank. Although this may have had nothing to do with this accident, there is an indication tha Maintenance had not really solved the problem although there had been 11 write-ups during the preceding five months. All had been corrected. The point is, was a rea fix ever accomplished? Or was the maintenance a case of fighting brush fires without getting at the real cause?

T-33

At 39,000 feet the T-Bird joc was getting turbulence, so he asked for and received a descent to thre

In four cases the aircraft crashed on final approach with the runway in sight. Two of these were fatal to the crew.

five zero. He also realized that he was dropping behind his flight plan fuel and time. He requested destination weather, got it: BELOW MINIMUMS. He requested clearance to another base, then changed his mind when he learned the RCR was three. His next request to Center was for the "nearest acceptable alternate." When he was 140 miles from there he decided he couldn't make it. At this point he declared an emergency and, with the assistance of Center, proceeded to attempt a landing at another base. He descended from three five zero, arrived at 3700 feet 20 miles out and initiated a GCA approach. At 2000 feet – on course and on slope – the bird flamed out. The pilot ejected at about 800 feet.

Primary cause: Pilot factor in that he delayed selecting a suitable emergency field and he used poor technique in descending too soon, which resulted in fuel starvation.

There have been some incidents that came within a hair of being full-fledged, grownup accidents. That they weren't is attributed more to luck than to anything else.

Item: During a C-119 local transition flight, the crew was making touch and go landings. At about 300 feet on climbout, Nr 2 began backfiring and losing power. The engine was shut down, tower advised. Then in the closed pattern, Nr 1 began to develop the same symptoms. This, of course, indicated that there indeed was something wrong and that *something* might not be in the engines. Sure enough, the IP discovered the fuel selectors were on the inboard tanks, which indicated EMPTY. Nr 1 fuel selector was changed to the outboard tank and the engine came in loud and strong. The crew made no attempt to restart Nr 2, and made a good single engine landing.

Item: During a chase mission at 5000 feet and speeds between 400 and 530 KIAS, the fuel low level warning light for the left engine of a T-38 illuminated with about 200 pounds remaining. The pilot turned toward the base, about 15 miles away, then the right side light came on. He called the tower and asked for a straight-in and was at about 1500-2000 feet on final with gear and flaps when the left engine flamed out. Fortunately, the right engine kept turning and a single engine landing was accomplished. Just as the aircraft was turning off the runway the right engine quit.

When the aircraft was refueled it was found to be completely dry. Nevertheless, with the tanks empty, the left gage read 80 pounds and the right gage 70 pounds. There are also some discrepancies in the T.O.s and an AFTO 22 was being submitted which may clarify these.

Item: A T-28 with two pilots aboard ran out of fuel and was landed by moonlight on an un-opened, partially constructed highway. The landing was good with no damage or injuries.

These pilots were lulled into a false sense of security by the fuel gage which indicated 200 pounds when, in fact, the tanks were dry. However, analysis of the flight plan revealed that there was not enough fuel aboard for the planned power settings; the wrong chart was used for planning the flight; the crew deviated from recommended power settings; fuel requirements for the major portion of the flight were not computed on the flight log.

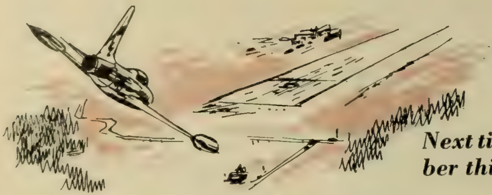
Item: On a U-10 flight the fuel pressure dropped, then the engine quit. The pilot switched tanks but couldn't get a re-start and made a forced landing in a field – no damage or injuries. The flight was being conducted on the right aux tank instead of main tanks. When this tank was empty the bird quit and the crew couldn't get it started.

All of the mishaps of this kind that occurred during the time period covered have not been briefed. For example, the F-100 pilot that received a GCA waveoff and decided to go to another base because of weather. When he departed the first base the flight was doomed – the aircraft just couldn't make it on available fuel. It didn't, but the pilot got out via the ejection route.

There was an F-101 from which the crew barely escaped in time when it ran out of fuel on final. The pilot hadn't been flying the bird very long, but his RO was highly experienced.

Eleven major accidents in 16 months due to fuel starvation indicate a serious problem. The cost is prohibitive, as indicated by the loss of three lives and several millions of dollars worth of aircraft, not to mention combat capability. While the solution of this problem is not confined to the following, correction of these inadequacies would appear to be a big step toward prevention of this kind of accident.

- Insist on better quality instruments. Fuel gages have been notorious for giving readings other than what is actually in the tanks.
- Improve quality control of rework of instruments.
- When repeat discrepancies occur in a system, make sure that the fix is really a fix and not merely a treatment of the symptom.
- Improve familiarization and checkout procedures for pilots transitioning into different type aircraft.
- Maintain closer supervision over new pilots and newly transitioned pilots. ★



Next time you make a precision approach, remember this is where many USAF accidents begin.

where the accident begins

Do most fighter pilots leave the precision glide slope about a mile out on final approach? We think they do — and we think we know why. More important though, is the possibility that many fighter people do it without realizing that they do or why they do.

We think it's very important that all fighter pilots understand the reasons behind this intuitive departure, because some of you will be sitting on an accident board some day with a responsibility to explain why another pilot did this—and why it led to an accident.

Here is the typical accident you will be dealing with. It will be a fighter or trainer undershoot out of a precision instrument approach. You will probably have GCA tapes, and they will establish that the pilot was warned that he was "too low for a safe approach, etc." The pilot will testify that this is true; he did leave the glide path, but only after he had the approach zone in sight. Thus, it is obvious that the total responsibility for the bash belongs to the pilot. After all, he was visual, and he had full control over a properly functioning aircraft. If it didn't look right to him, he should have gone around. The fact is that he didn't, so it must have looked all right to him. About all this leaves you with is the conclusion that his judgment was bad.

Most such accidents do enter the books just that way. Pilot error: faulty judgment during visual flare-out.

As a board member representing fighter operations, you owe it to yourself and your brother pilots to try to find the *total* cause of such accidents. The pilot error factor won't help a soul as far as preventing another one like it. How do you profit from hearing that someone did something that you already know you wouldn't do? Particularly something as intangible as misjudgment!

Take it further—dig deeper. Try to find out whether he really believed he could hack the landing or whether he felt that he had to. Chances are that there were some elements of tension present that induced him to press a little harder than he might normally push to get the bird on the ground on that particular pass. Such things as low fuel, rapidly deteriorating weather and minor malfunctions have been evident in the past.

If you can find a little clutch factor of this sort, you

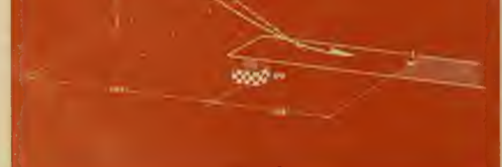

AVERAGE DISTANCE REQUIRED
VISUAL LANDING TEST FLIGHTS
PROFILE OF TESTS USING EXISTING GCA GLIDE PATH

Fig. 1

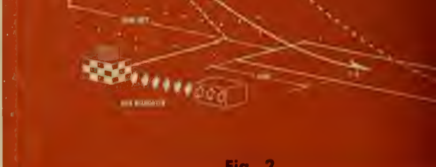

DESIRED FIGHTER PROFILE
OPTIMUM FOR 1000 ft TOUCHDOWN
NATURAL PROFILE FROM EXISTING GLIDE PATHS

Fig. 2

have half of a valuable contributing cause. Now, we'll give the other half on a platter. It is simply that our precision approach aids, in their present configurations, provide less than optimum assistance to fighters. We're referring to the fact that a fighter pilot can't use precision glide path information in the final mile or so of his approach, because it would keep him too high to land in the prescribed touchdown zone.

Now all fighter pilots seem to realize this because they all drop below glide path as they begin their visual maneuvering for landing. But just knowing this and accepting it as a fact of life is not going to help protect anyone from parlaying this little maneuver into an undershoot accident.

What we need to do is define and understand the problem so that everyone will know exactly what he is up against when things get tense.

The Landing Profile. Back in 1960, ASD (then WADD) ran a flight test program to determine the relationship between the GCA Glide Path Intercept Point (GPIP) and actual touchdown point, in century series fighters. In this test the pilots remained hooded until reaching 100 feet. They then raised the hood and put the bird down as soon as they could. The average for the 62 runs was 1800 feet beyond GPIP. One landing ran 2400 feet beyond.

We've diagramed that average in Figure 1. This diagram is useful to us because we can draw some accurate measurements from it, and even support some conclusions about the normal landing requirements of fighter aircraft.

For instance, the test report concluded that if a pilot stays on glide path and approach speed to an altitude of 100 feet, he can expect to touch down about 1800 feet past GPIP. We can also measure the distance between the start of the visual landing effort and the touchdown point, and conclude that it takes over 4000 feet of distance to accomplish a landing, if you start from 100 feet.

Wouldn't you also agree that, if a pilot wants to touch down at the 1000-foot point on a given runway, he should make an effort to be at about 100 feet at a point about 4000 feet back from his intended touchdown point (Fig. 2)? This seems real reasonable to us.

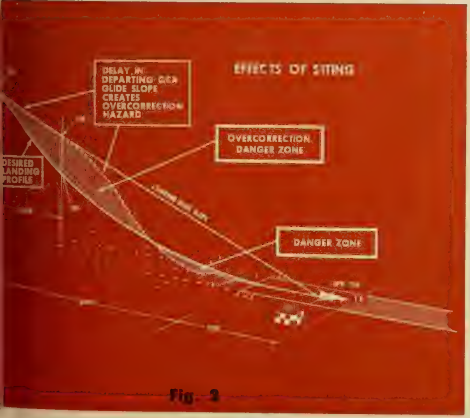

EFFECTS OF SITING
DELAY IN DEPARTING GCA GLIDE SLOPE CREATES OVERCORRECTION HAZARD
OVERCORRECTION DANGER ZONE
DESIRED LANDING PROFILE
DANGER ZONE

Fig. 3

Next, since touchdown zones are always defined by directive, and the requirements of the airplane are pretty well fixed, wouldn't it be nice if the precision glide path would steer you right to a point about 100 feet above runway elevation about 4000 feet before touchdown?

They don't you know. Figure 3 shows that if you lay out the landing profile with the touchdown point at 1000 feet and then plot a 2½ degree glide slope with the GPIP at 750 feet, the glide path passes well over our 100-foot "key" point. About 60 feet high by our calculations.

Most of us have hardly ever noticed the minor correction required to compensate for this 60 feet. And there's good reason for this—most of us had the approach lights in sight at least a half mile from them. A sixty-foot adjustment spread over a half mile is nothing.

But how about a situation where you can't leave the glide path until about one-half mile from threshold, which is right over the "key" point? Not all approach lighting goes out the full 3000 feet and some of the runways our people are using today don't have any at all.

At 180 knots you're traveling 300′/sec, and already descending at a rate of 800′/min. To make a 60 foot correction within 1000 feet of travel, you'd have to increase your rate of descent by 1100′/min. Obviously that's too violent. If you can begin 2000 feet before key point, you can spread the correction over about seven seconds. That's a descent increase of 550′/min, or a total of 1350′/min. during the correction.

Now that really isn't much of a dive, but it is steep enough to tempt a power reduction by a pilot who is looking at a short wet runway. This is where an undershoot accident can begin. If a pilot pulls off too much power in this pushover, he may run out of speed before reaching threshold. If he pushes over too steeply, he may hit an approach light during flareout. Obviously, a little of each can lead to the same results.

Give this point some thought next time you shoot a precision approach. Make your own assessment of the influence that a precision glide path has on your final visual maneuvering. We think you'll find that its importance varies inversely with runway length and visibility—being no problem at all on long runways that have lights and strobes stretching 3000 feet out from threshold, but presenting a major challenge on approach to a short runway with minimum lighting.

Just recognizing a problem of this sort is worth a lot. As a pilot, it will help you to avoid getting sucked in by a bad situation. As an accident investigator, it may help you to understand why someone else had an accident. It can do even more for staff planners: Headquarters USAFE and the Royal Canadian Air Force have already moved many of their precision aids (GPIPs) closer to threshold to give their fighters a better break. Air Defense Command is studying the problem closely. We at the Directorate of Aerospace Safety are too—we'll keep you informed. ★

WINTER WORRIES

Earmuff and overcoat time is arriving and with it the problems that accompany icy ramps and runways, low ceilings, frost bitten fingers and all the other discomforts and hazards we have to contend with. Experience and ingenuity have given us the equipment and knowledge to operate safely, but we have to *use* them and be especially watchful to prevent the kinds of mishaps that are peculiar to this season.

Flight accident prevention in the winter starts on the ground — perhaps more so than during any other time of the year. This is the season when we call upon our maintenance people to the utmost: often they are working under the most adverse conditions, yet the requirements of their trade are most exact.

Pilots must be able to depend on the performance of their instruments during approaches through murky weather; they will be depending on proper operation of brakes, nose wheel steering, and drag chutes more on slippery runways. Their fate may also rest with the men who operate the machines that clear ice and snow from runways, taxiways and ramps. Barriers must be properly maintained to prevent freezing of the mechanisms. The pilot will have to contend with a lot of other problems: freezing rain, blowing snow and ice crystals, structural ice, engine ice, carburetor ice on recips.

We said flying accident prevention, especially in winter, begins on the ground. Aircraft preparation, therefore, is extremely important. Let's consider some of the things that must be accomplished before the aircraft ever gets off the ground.

Maintenance, as well as Operations, can make good use of the weather forecaster. He can be of great assistance in helping maintenance people prepare for adverse conditions before they arrive. Consult him.

A major problem during this season is the removal of snow, ice and frost from aircraft surfaces. Procedures are spelled out in T. O. 00-60B-1. Deicing fluid is a 3:1 mixture of ethelyne glycolpropylene glycol, MIL-A-8243A. This material is somewhat toxic so certain precautions are necessary: Avoid getting it on your skin and in your eyes, and it should not be used in heat and vent systems since it may produce toxic fumes.

Deicing fluid is very effective when used on frosty or icy aircraft surfaces and, indeed, may be applied prior to these conditions developing. It should not be used as a preventive when snow is expected, except in conjunction with protecting covers. If the aircraft is outside, with no protection, and snow is expected, do not apply deicer fluid as a preventive since it will form a mixture with the snow that can become exceedingly hard to remove. Freezing rain may dilute the fluid or wash it from the surfaces, so keep this in mind when this condition exists.

On snowy surfaces, first remove the snow with a soft brush or broom – never use a sharp instrument of any kind – then apply the deicing fluid. In general the solution is sprayed from the top of the aircraft down and from the leading edge of the wings aft. Do not allow deposits to build up in control surface openings, vents and hinges. Water and slush in control surface cavities may freeze solid, especially in flight at extremely cold altitudes, and lock the controls.

Cleaning the snow from an aircraft can be hazardous because of the slippery surfaces. Ramps, workstands, ladders should be used as much as possible to minimize workers walking on slippery surfaces.

Frequently repeated applications of deicer will be necessary to remove hard deposits. When aircraft will be operating on slushy taxiways and runways a protective coating of fluid will be needed on the under surfaces of wings, ailerons and horizontal stabilizer. This will help prevent slush from sticking.

While on the subject of deicing, we'll pass on an incident that occurred last winter. Don't let this happen to you. The flight of four – a T-33 and three deuces – were practicing intercepts away from home base. They set down, asked for fuel, deicing because of the weather, and a fast turnaround. While they were filing, the weather moved in. When the pilots returned to their aircraft they were appalled: The birds looked like they'd been stored in a deep freeze. Personnel at the base claimed that the damp, cold weather caused the aircraft to look like ice cubes. The pilots were never convinced that water hadn't been inadvertently sprayed on the birds.

Remember, during very cold weather metals contract as do seals, which also harden. Hoses become brittle and damage easily. Leaks in fuel, hydraulic and pneumatic systems may develop. These leaks normally are minor and as soon as the system heats up, seals, O rings and hoses return to their normal state and the leaks disappear. While on the subject of leaks, don't be surprised if they appear after an aircraft is removed from a warm hangar to the outside cold. Also a coat of frost may form quickly on the warm aircraft and this may have to be removed.

Hydraulic systems are susceptible to low temperatures. In addition to leaking, they probably will become sluggish which will require them to be activated to warm up the fluid. Prior to operation from the cockpit, controls should be moved from stop to stop manually. After that they should be operated gingerly until the system is within normal operating range. In the event that controls are bound with snow or ice, this must be removed and the area dried.

Doors and access panels may be frozen shut. An application of deicer around the edges will normally make these easy to open. But remember that panels and doors stored in a warm hangar may not fit properly on an aircraft that has spent the night outside.

Landing gear struts may require special attention. Use care in towing over rough ice and snow when it is very cold and grease in the wheel bearings is stiff. Heating is not recommended because it may cause moisture to condense, which can impair lubrication and subsequently freeze.

If gear struts are partially collapsed don't be surprised. This is generally no problem, but keep struts, hydraulic pistons, valve plungers, gear switches and torque arms free of dirt, snow and ice. This can be done by brushing them, then applying deicer. Then clean these parts and apply a light coat of fluid to prevent formation of ice.

Now for a few don'ts:

- Don't allow deicing fluid to contact bearings; it may dilute the grease.
- Don't heat aircraft interiors before removing snow from the fuselage. This may cause the snow

Some aircraft have overcoats which protect surfaces from ice and snow.

Extreme weather conditions place exacting requirements on men.

to melt with subsequent refreezing.

- Don't tighten cables and nuts too much when the temperature gets below −15° to −20° F. When the aircraft warms, expansion may cause failure.

Oil dilution and proper engine heating is important for reciprocating engines. When they are first started it may be necessary to motor each engine to reduce excessive hydraulic, engine and alternator oil pressures. Operate at idle until oil pressure stabilizes in the operating range. AC generator frequency will normally remain high until the constant speed drive is warmed up. Don't place the generator on the bus until the frequency stabilizes at accepted values.

Never operate nosewheel steering while the aircraft is stationary. Since this system may be sluggish, make gentle turns initially.

While taxiing avoid maneuvering near other aircraft and stay away from deep snow and slush to prevent buildup of moisture which may freeze on takeoff.

Just a word about carburetor ice. Despite the Dash One, training, articles in safety magazines and experience, this continues to be a problem. Let's see if we can't finally lick it. The time for carburetor heat is *before* not after the ice forms. Watch the gage. If it's in the green, okay, but you've got to watch it, especially when operating at low power, such as during letdown and approach.

For aircraft in flight the most serious problem usually is structural ice. We are bound to get it at times but, like a hangover, it's easier to prevent than to remove. Whenever possible, avoid known icing conditions. Use heat and anti-icing fluid judiciously before ice forms.

During the winter months one of the pilot's main concerns is staying ahead of the weather. Failure to do so has resulted in many a tragedy. METRO is ready to help, so get on 344.6 and find out what conditions are ahead. Planning becomes extremely important. Stretching fuel is like playing Russian Roulette, when the destination has freezing rain and the fuel gage tells you your alternate is impossible or just marginal. This may be pretty basic advice, but it is repeated because every winter there are a few who failed to get the word.

Every pilot knows that weather is changeable and that sometimes it changes amazingly fast. Consider the following incident and imagine that you were trying to get into this base rather than out. While the aircraft was running up prior to takeoff, visibility dropped to one-sixteenth mile in fog. The pilot taxied back to the ramp. Meanwhile nearly half an inch of ice formed on the props, nacelles and wings. Most of it was blown off during runup but reformed during taxi-back. Earlier the weather was generally clear with the temperature ranging from 30 to 34 degrees. During a 45 minute period visibility went from clear to one-sixteenth with humidity at 100 per cent, then to one-fourth mile and finally cleared.

SURVIVAL

This winter some pilots and perhaps other crewmembers will have to bail out. This may occur, as in the past, in extremely cold, remote areas. Personal equipment people, therefore, must exert extra care to assure that survival kits are complete and that radio batteries are not permitted to deteriorate. Crews flying in cold areas must attend to obtaining and using proper winte clothing. Now is the time to bone up on survival techniques.

A word of caution that has bee repeated many times but too ofte goes unheeded: Aircrews flyin from warm southern bases to northern bases should be prepared fo the worst. It is easy to be lulled b a warm climate to forget tha your route may take you over area of arctic-like temperatures, even though your destination might have a fairly high thermometer reading. Kirtland, for example, might be reporting in the 60's but those hills around it may be down in the 20's or below.

If you fly a transport you have additional responsibilities. Passengers generally wear clothing suitable to the climate in which they live. A light uniform, low-cut shoes and a person accustomed to a mild climate do not add up to a very good survival risk.

This article is not all-inclusive. It is intended to hit some of the high spots — hazards that have caught up with the unwary in the past. We believe that accidents are no more prevalent in the winter than during any other part of the year. We know that there are more hazards, and that the price of prevention is awareness of these hazards and performance that prevents them from becoming accidents. Have a good winter and be around next year to read the next article of this kind. ★

Slippery Runways

Maj Guy J. Sherrill, Directorate of Aerospace Safety

This seems an appropriate time to suggest a review of landing techniques before winter comes and "μ" goes all to pot. (μ-friction coefficient.)

Over the years, and particularly over the summer months, the word has been out to let 'em roll to the end and save on brakes and tires. This, combined with 12,000-foot runways and human nature, has resulted in habitually long landings. After all, why sweat out an exact approach speed, a precise touchdown, and prompt chute deployment when all it means is adding a bunch of power to get to the prescribed turnoff point? Consequently, we find ourselves grossly out of practice for landing on the slickeries.

Now you may feel that this only happens to other people, that you can always summon up your incomparable skill and instant reaction time without benefit of practice and pre-conditioning, and that you always do better in the clutch. If so, our 10,000-foot runway at Norton will stay pretty dry until December. Come on out, or down, as the case may be, and browse through the statistics of those who felt likewise. Otherwise, get with the Dash One and work out some unit procedures to practice slippery runway techniques while the sun still shines.

Refamiliarize yourself with such terms as RCR, aerodynamic braking, hydroplaning, and coefficient of friction. Knock off those increments of final approach IAS you've been arbitrarily adding for mama, each ankle-biter, and old Ish. Think through, and practice, use of back stick after the nosewheel is on the runway to give you both additional drag and increased brake effectiveness.

While you're working on this subject, a word about barrier philosophy is also in order. This magazine recently pictured a group of smiling pilots obviously proud of the fact that they had become enmeshed in arresting gear. The caption further stated that several other unit pilots had also achieved the same distinction but were not available for the photographer. Bah and humbug!! Anytime half the pilots of a unit have stopped in the barrier, facilities, operations—or maybe both—leave a lot to be desired and should be corrected. The availability of reliable arresting gear cannot be considered a panacea for substandard facilities, poor operational policies, or inept pilot technique. If you've done everything possible and still have to take the cable, be thankful it's there, but unless you're wearing brown shoes and gold wings, arresting gear engagement has not become an accepted and admirable manner for routinely stopping an airplane.

As a sterling example of what can be accomplished by exact flying, the troops in Alaskan Air Command have been routinely operating Deltas for years from a 6600-foot strip with a 14-foot dike immediately adjacent to each end. This runway, 240 NM from the nearest alternate, is frequently subject to very low RCR's, low ceilings, and heavy crosswinds. Yet, there has been but one cable engagement! These pilots profess no secrets beyond exact final approach speeds, precise touchdown point, and published stopping procedures. But perhaps of more importance is that they follow their peerless techniques on every landing, even on Eielson's 14,600′ superhighway. Their short field, slippery runway capability is therefore always immediately available.

In other words, the subject is summed up by our poet laureate as follows:

When the weather's hot and humid
Sloppy landings are merely stupid.
But when the frost is on the punkin',
That's no time for Delta dunkin'. ★

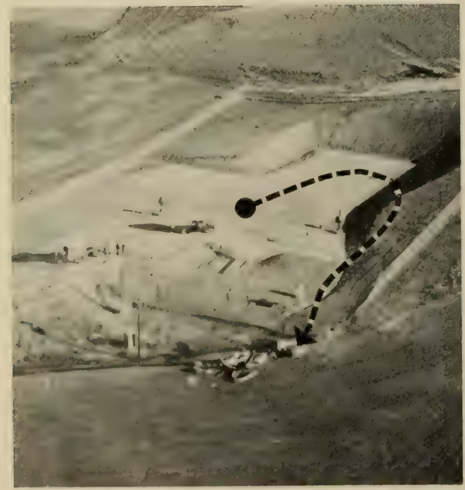
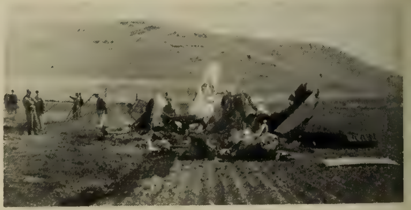


Photo at left shows flight path of helicopter. Extent of wreckage is shown above and below. All aboard escaped although some received burns.



Requiem for a Chopper

Maj Thomas J. Slaybaugh, Hq USAFE

Study these photographs. A stark tale of tragedy unfolds. The heavy chopper started to lift off the graveled surface, proceeded toward the embankment at the right of the picture, faltered, moved to the left, struck the fence, crashed into the ground short of the power lines, settled on its side and caught fire.

The cabin door was on top. Occupants unlatched it. They could not get the door open. Melted nylon began dripping from straps inside the cabin. One of the pilots crawled through a cockpit window broken out in the crash. He ran around and pulled the cabin door free. All crewmembers and passengers escaped.

The board reported that the primary cause factor for this accident could not be unconditionally determined due to the extensive fire damage following the accident. They reported, however, that the most probable cause was pilot factor, in that a loss of aerodynamic lift caused by a reduction of rotor RPM, probably induced by improper pilot technique, was indicated. They reasoned that reduction of rotor RPM was probably caused by either inattention of the pilot to his power indicating instruments and subsequent over demand upon the rotor due to excessive use of collective pitch, or to a too rapid application of pitch which, in effect, called for more power than the turbines were capable of producing. In either case, the aircraft would be placed behind the power curve and into a flight condition from which it was impossible for the instructor to make a safe recovery. The board recommended that all pilots flying this type helicopter be briefed that, under maximum performance operation, optimum pilot and aircraft performance is necessary, and that the use of engine instruments is essential for establishing power settings.

ADDITIONAL FINDINGS

Although, in the opinion of the board, the following findings did not contribute to the accident, they included them in their final report:

Obstruction or terrain hazards that make such areas as this incompatible with approach or landing safety for this type helicopter are not taken into consideration. The only criteria is that the transverse and longitudinal slope will not exceed four per cent. They suggest such criteria be reviewed and the necessity of including terrain and obstruction clearance be considered.

Presently, cleaning fuel filters is left up to individual opinion during even numbered phase inspections. They recommend that fuel filter cleaning be made mandatory during these inspections.

The present checklist does not provide the pilot with a takeoff checklist for intermediate stops. They recommend that the checklist be revised to provide such a section.

After impact passenger efforts to evacuate the burning aircraft were frustrated due to inability to reach the emergency release handle or open the door after actuating the normal opening handle of the passenger/cargo door. They recommend that consideration be given to either relocating the emergency release, where passengers can get at it regardless of the position of the fuselage, or providing additional emergency release devices.

Efforts of the passengers to get out of the fuselage and escape from the fire by using the pop-out windows and emergency escape hatches were foiled because nylon seat backs covered these exits. The board suggested that leaving strategic areas of egress uncovered by seat back webbing during passenger carrying operations be evaluated.

Several passengers received third degree burns during escape from the aircraft due to contact with molten fragments of nylon from the seats and interior materials. It was suggested that an evaluation be made relative to replacing nylon materials with a material less hazardous to personnel in a fire environment.

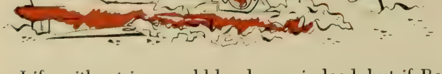
Work has been done on compressor stator blades, but documentation of this work was not made in the 781-A, nor was the required inspection performed or documented. Necessity for an operational check was known, but was not entered in the 781. On this matter the board recommended proper recording of all aircraft discrepancies, subsequent maintenance to clear such discrepancies and the necessity of inspection by a qualified inspector.

Tear down reports failed to disclose materiel cause factors. ★

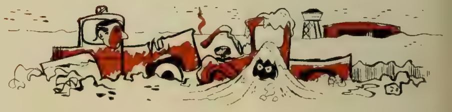
Rex Riley
CROSS COUNTRY NOTES

WINTER WORRIES

An aircraft was damaged last winter and an F-6 refueling unit destroyed by fire and explosion because of ice clogging vent tubes on top of the refueler. Instructions stenciled on the refueling units direct that manhole covers be removed when pumping oil or fuel below 25°F. This was not done and ice clogged the vent tubes which resulted in collapse of the unit.



Life without ice would be dreary indeed, but if Rex had his druthers he would prefer it in the form of little cubes. In other forms it often causes all kinds of trouble. Last winter, for example, a pilot of an F-106 had to abort. No sweat, there was the cable out ahead. Unfortunately, ice not in the form of little cubes got into the act. The ice formed in the fairlead tube of the BAK-6 immobilizing the purchase cable to the extent that when the aircraft engaged the barrier the cable failed. During installation of the barrier, provisions for proper drainage of surface water from the vicinity of the mouth of the fairlead tubes had not been provided. To advise Civil Engineering to make a check of barriers for a similar condition might be trite, but if this had been done prior to the mishap related above, it might never have occurred.



Arresting barriers installed at Air Force bases are there for the purpose of stopping aircraft in an emergency. But if they will stop an aircraft, they are also capable of stopping other vehicles. Here's a case.

One afternoon last winter at an overseas base, snow had accumulated to the point where it became necessary to remove it from the active runway. A snowplow was dispatched along with an observer in a pickup truck. Since the snowplow was not radio-equipped, the truck with radio was required to maintain contact with the tower.

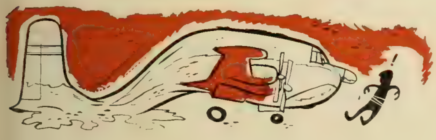
After several passes up and down the runway, the plow caught the arresting cable and slowed to a stop. The airman in the pickup was about 40 feet behind the plow. For a moment the pickup driver was distracted by a tire waving in the air (tire was attached to the barrier cable). When he looked back he saw the plow had stopped. The airman jammed on the brakes and tried to turn but was unable to avoid hitting the snowplow. He received minor injuries.

The factors involved in this mishap may serve to alert personnel at some of our bases this winter:

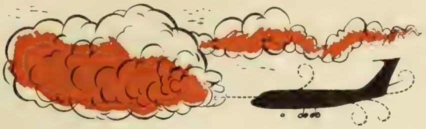
- Driver of the pickup was not experienced in driving on icy surfaces.
- Visibility was poor.

- Pickup driver was following close behind the snowplow instead of to the side.
- Pickup was not equipped with chains or snow tires.
- Pickup had no seat belts.

THE CASE OF THE LEFTOVER BOLT. Immediately after the big jet had been taxied out of the parking area a sharp-eyed ground crewman spotted a ¼-inch hex-head bolt, 3½-inches long, near one of the wheel chocks. The aircraft was stopped and inspected for loose objects or obvious missing bolts. Nothing unusual was observed. Takeoff was made on schedule. Soon after flap retraction, a light to moderate elevator buffet was experienced between 200 and 300 knots. Buffet intensified as power was applied and back pressure placed on the control column for climb. Buffet decreased when power was retarded and the aircraft flown straight and level. A controllability check was made and all buffet ceased when flaps were extended to 30 degrees. Controls were normal. Landing was uneventful. The aircraft was isolated and when the controls were thoroughly inspected the inboard hinge bolt of the left inboard aileron tab was missing. Right, a ¼-inch, hex-head, 3½ inch bolt is used in the inboard hinge.



IMPROPER HANDLING OF CARGO. The following incident falls in the "What Makes Rex Mad" category. During off loading of a C-124, the loadmaster and airfreight personnel discovered a box leaking an unidentified liquid. When the box was turned over, the special handling label identified the contents as acetic acid. The package had been stowed under and along with general cargo. When the box was opened, investigators found a one-gallon bottle with a broken plastic stopper taped in place. The position of the box placed the bottle on its side. The tape appeared to be standard O.D. tape which was also used to tape the box containing the bottle. About a quarter of the fluid had leaked out of the bottle onto the hatch of the rear compartment and then into the rear compartment causing considerable damage. The crew was not briefed on the presence of "Special Handling Cargo." AFM 71-4 covers packaging and loading of caustic materials. Rex suggests some boning up on the provisions of this manual.



KUDOS. Occasionally Rex reads reports of aircraft damaged on the ground because of high winds accompanying storms. Usually the explanation given is an "Act of God." Well, here's a case where a base suffered severe damage but through proper precautions did not lose a single aircraft.

A squall line with severe thunderstorms hit Perrin Air Force Base during midafternoon on June 15. The wind, gusting at times to 60 knots, damaged nine buildings, tore six dock pilings loose from their concrete footings at Lake Texoma, blew two trailers off their blocks and inflicted other damage. The aircraft were well secured and none was damaged. Good work!

FOUNDATION FOR SUCCESS. RC-130A Passing through 15,000 feet, during descent, fire warning lights for Nr 3 and Nr 4 engines illuminated, simultaneously with the master fire warning light. The scanner reported tailpipe vibrations on Nr 3. The crew followed Dash One procedures in shutting down Nr 3, then Nr 4. An emergency was declared and subsequently a two engine landing was accomplished.

Successful handling of an emergency, without injury or damage, is always commendable and generally is due to decisions based upon knowledge of equipment and operator capabilities. Qualified crewmembers completely familiar with their equipment are our best insurance in any emergency situation. Some emergencies allow time to seek and obtain advice from specialists, but when fire warning lights illuminate, the decision must be made now!

With indications of a dire emergency, this crew took the action that, to them, was the safest course open. They waited until they got on the ground to discover that Nr 1 and Nr 2 power plants were fully capable of normal operations. It was then that they discovered that phase A and D bulbs on Nr 3 engine and phase A and B bulbs on Nr 4 engine were defective.

I congratulate this crew on their success.

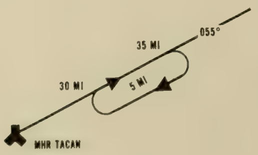
From a safety standpoint, taking timely action to minimize the hazard and landing at the nearest suitable base is in accord with approved accident prevention procedures. Also from the safety standpoint, such incidents should provide added incentive to continue the search for more reliable fire warning systems. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. **You are given a clearance to hold right hand on the 360 radial between the 10 and 16 mile DME fixes. Do you hold outbound with the 16 mile DME fix as the holding fix, or inbound with the 10 mile DME fix as the holding fix?** *(Captain John E. Hubbard, 4th ATS, McChord AFB, Wash.)*

A. Your clearance does not provide sufficient information. Holding instructions should be issued in accordance with the ATC Procedures Manual, AT P 7110.1B. A TACAN holding clearance should contain the following minimum information: (1) Direction of holding from the fix, (2) holding fix, (3) radial, (4) leg length in miles, and (5) direction of turns only if left turns are to be made. For example: "AF Jet 12345 hold southwest, 35 mile DME fix, Mather TACAN 055 radial, 5 mile legs." Notice that the direction of holding is geographical from the holding fix, i.e., holding is accomplished southwest of the fix but northeast of the station. (See diagram.)



Q. **When performing a teardrop entry into the holding pattern, should a course or a heading be maintained during the outbound portion of the maneuver?** *(Major Tom Reed, Bunker Hill AFB, Ind.)*

A. The teardrop entry to the holding pattern is designed to place the aircraft on or close to the inbound holding course. This can be more accurately accomplished by flying a course than a heading. The bearing pointer, CDI, or a combination of both, can be used effectively to intercept and maintain the outbound course. The turn inbound should not be delayed if the course interception has not been completed when reaching the prescribed limits. If no positive course guidance is available (TACAN fix, intersection, etc.) a heading should be flown to parallel the teardrop course.

HOT

Q. **My initial ATC clearance from Ground Control included a "Podunk SID." After takeoff I receive a radar vector which takes me off the Podunk SID route. Am I still required to conform to the SID altitude restrictions?**

A. The first and most logical answer is to ask the controller for clarification. However, AFR 55-106, para. 6a(2), directs the pilot to conform to the exact routings, altitudes, and specific restrictions as shown on the SID or as amended. Since you have not received amended altitude information, you should conform to the published SID altitude. The controller should state his intentions when he issues the amended routing. REMEMBER — if there is any doubt, ask the controller!

Q. **You are flying the VOR/ILS, RWY 17-2, to Blytheville AFB (High Altitude, SE). On the 110 degree portion to intercept either the 352 radial or the localizer, you know your drift. Should you apply this known drift to the 110 degrees?** *(Captain Frank P. Trammell, 93 ARS, Castle AFB, Calif.)*

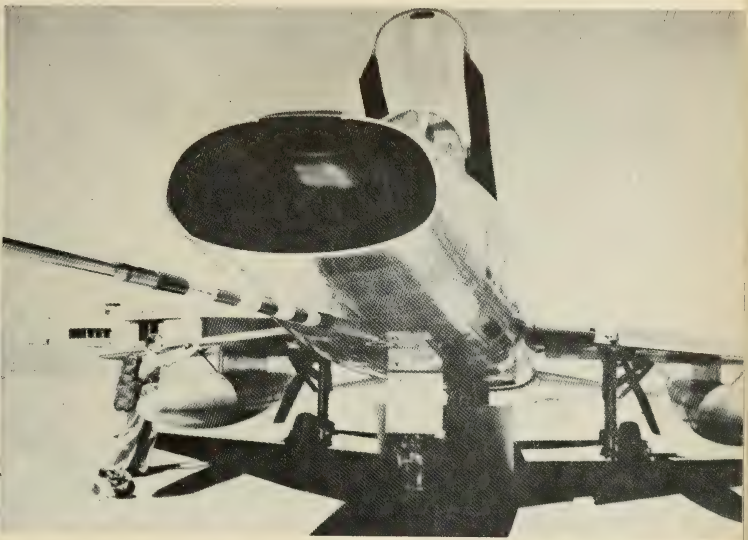
A. Yes. The actual path of your aircraft over the surface should conform as closely as possible to the published penetration.

POINT TO PONDER

During the preflight planning phase of a standard instrument departure, try comparing the SID with an instrument approach procedure chart for the airport. Obstructions in the area may not be printed on the SID, but are immediately apparent on the approach chart. Also, information such as minimum safe altitude 25 NM or emergency safe altitude 100 NM may be handy in case of an emergency after takeoff. Bearings and distance to NAVAIDs in the vicinity of the airport can be determined from the approach chart, and in the absence of published ground check points, could be used to check your VOR, TACAN, or ADF equipment. In addition to contributing to your knowledge of the SID route, you have familiarized yourself with the approaches available for landing immediately after takeoff. Have the approach chart readily available during the departure. ★

F-100 WING SLAT PREFLIGHT

Capt James P. Gammon, Jr.
eprinted from — Nellis AFB Fighter Weapons Newsletter
rt supplied by — No American Avn



Although the wing slats on the F-100 may retract and extend smoothly, other factors such as alignment and proper clearance are essential to correct slat operation.

Is there a bird in your unit that reacts a little strangely — or even downright nasty — during high performance maneuvers? Does it have a tendency to yaw, roll, or snap — or require an abnormal amount of rudder to maintain coordinated flight while operating in critical, or even near-normal, angle of attack areas? If the answer to any of these is in the affirmative, then the problem may be traced to one of two possible major sources. The first cause can be classified as a case of ham-fisted airplane driving. Assuming that more than just one or two individuals have experienced an unexpected "thrill" with the particular machine in question, we will eliminate pilot-induced causes and look elsewhere. It then must be the airplane.

Flight control rigging will often draw a jaundiced eye, but what about those leading edge wing slats? Can you be sure that they are actually in good operational shape simply because with little effort, they retracted and extended smoothly during the walk around inspection? Though the principle upon which they operate is indeed simple, they are in fact a bit more complicated, and far more critical, than most jocks might realize.

The following description of an operationally-oriented preflight of the leading edge slats is based on data extracted from T.O. 1F-100D-2-5. It is not our place nor intent to qualify a set of go-no-go conditions, but rather provide ops types with some guide lines to assist in determining if the behavior of a cranky bird is in fact due to the wing slats, or some other rigging problem.

There are five leading edge slats on each wing. Numbers 1, 2 and 3 are interconnected to form the inboard set, and numbers 4 and 5 are similarly joined to make up the outboard set. The illustration at right denotes the system used to identify each slat numerically.

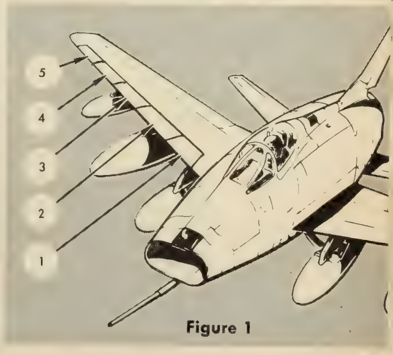


Figure 1

leading edge slat preflight

1. Push inboard and outboard slats into the retracted position and check for alignment with wing. The trailing edge of the slat should be flush with the wing leading edge (see Fig. 1). Number four and five slats should have forward track stops which will position them out approximately ¼ inch for the outboard end of the number five slat graduating to ½ inch for the inboard end of number four slat. Check that all four track stops are contacting their respective track rollers on Nr 4 and 5 slats.

2. Release the slats and check the alignment of Nr 3 and 4 slats fully extended. Figures 2 and 3 indicate the tolerance of misalignment between Nr 3 and 4 slats.

3. Check installation and freedom of movement of all slat track bearings and side rollers. Side rollers are installed on Tracks 2, 4, 6, 8, and 9. Refer to Figures 4 and 5 for tolerances. The slats must move easily without binding or rubbing.

4. With slats extended, check that interconnecting spacers are free and full-floating. Coating may build up which prevents free movement.

5. Make visual check of bumper washers. Missing or badly worn bumper washers should be replaced. Bumper washers are installed on the outboard section of Nr 1 slat, the inboard and outboard sections of Nr 2 slat, the inboard section of Nr 3 slat and the outboard section of Nr 4 slat and the inboard section of Nr 5 slat.

6. Check clearance between Nr 3 and Nr 4 slats. The clearance should be .218 to .343 inch, and should be the same as the clearance between the same two slats on the opposite wing. The measurement should be taken between the outer-

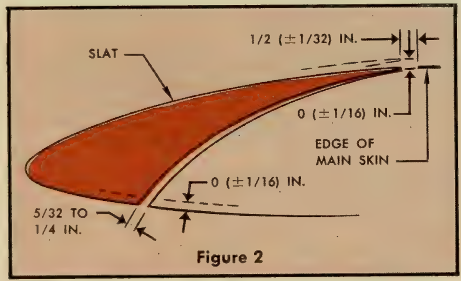
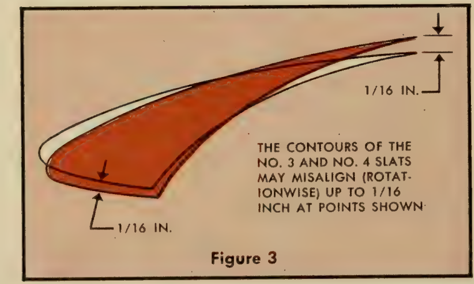
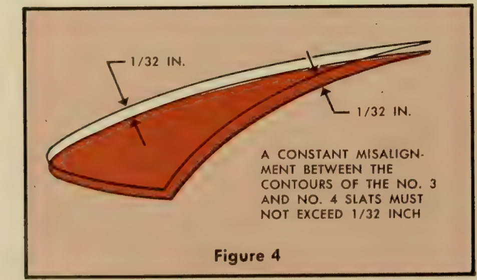


Figure 2



THE CONTOURS OF THE NO. 3 AND NO. 4 SLATS MAY MISALIGN (ROTATIONWISE) UP TO 1/16 INCH AT POINTS SHOWN

Figure 3



A CONSTANT MISALIGNMENT BETWEEN THE CONTOURS OF THE NO. 3 AND NO. 4 SLATS MUST NOT EXCEED 1/32 INCH

Figure 4

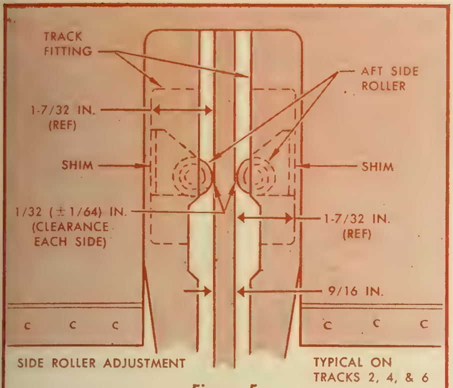


Figure 5

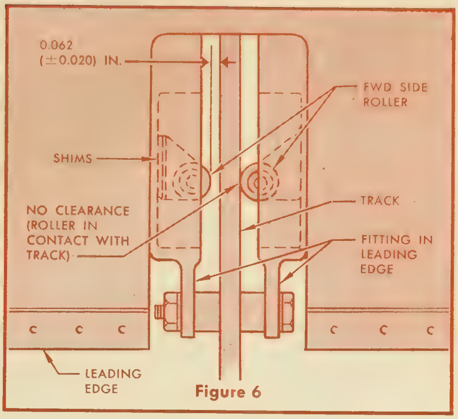


Figure 6

most part of the Nr 3 slat and the innermost part of the Nr 4 slat, not considering the rollers or rub strip on the Nr 4 slat. The clearance should be checked with the slats in the extended position and in the retracted position (see Fig 6).

NOTE: The Nr 3 slat may be either of two lengths, depending on its part number (192-17203-201 and -202 slats are ⅛ inch shorter than 192-17203-1, -2, -101, or -102 slats). It makes no difference which slat is used on a given airplane, as long as the same length is used on each side, and it is given proper consideration during adjustment of the slats.

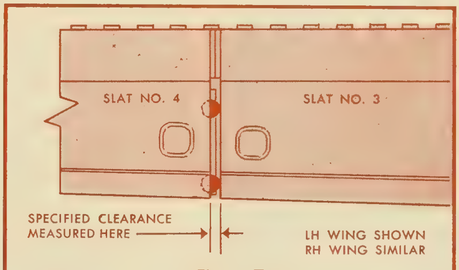


Figure 7

⑦ All tracks contain rubber cushions (leading edge slat track bumper assembly) to reduce shock when they bottom in their extended position. If these bumpers are missing or deteriorated they should be replaced.

⑧ Proper slat operation requires clean tracks, rollers, and bearings. They should be cleaned as often as necessary with a clean, lint-free cloth dampened in stoddard solvent (federal specification P-S-661). Special care should be used to keep solvent out of the inner parts of all rollers and bearings.

Isolating aircraft rigging problems is at best a difficult, and almost always, time consuming task. A thorough preflight will often provide the means of nipping in the bud a wing slat discrepancy that could later prove to be not only somewhat disconcerting, but plain dangerous. And if the bird still displays those "weird" flying characteristics after passing such a meticulous slat inspection, at least the flight line and field maintenance crews will know where *not* to look.

Good maintenance is a two-way street. On the operations side of the fence, the squadron pilot is in effect an important factor in any quality control program. If the pilot possesses a detailed knowledge of the airplane, and is capable of entering detailed, intelligent write-ups when things aren't as advertised, then the odds are that maintenance will follow suit and furnish the high caliber product expected. ★

GREEN LIGHT for safety

Lt Col Curtis N. Mozley
Directorate of Aerospace Safety

"The Safety Program is every one's responsibility." A commander, to remain a commander, must be fully aware of this basic fact; a supervisor, to be qualified as a supervisor, must be a strong supporter of the expression; and most important of all, the safety officer must be the prime instrument in spreading this philosophy.

Why is it then, that people from all these areas who have been grouped together for the purpose of surveying and aiding others in functions of command and supervision, tend to forget?

The safety officer is charged with a responsibility, but is given no authority. He and his people cannot direct that unsafe practices be changed or that hazardous conditions be corrected. He can, and must, advise the commander that situations needing corrective action do exist. He can document these shortcomings and should take follow-up steps until the deficiencies have been alleviated, but he can't direct the action.

A major function of any commander is direction of the proper authority, be it Maintenance, Operations, Civil Engineering. It is then up to the agency having the capability, personnel, and authority to correct these shortcomings. The discovery of a safety discrepancy doesn't necessarily indicate that the safety officer, or his people, are derelict in meeting their responsibilities. If the discrepancy has been documented and the agency with the corrective capability is aware of its existence, it is the responsibility of the surveyor to place the blame where it belongs.

The tendency to make the safety officer the scapegoat during safety surveys does not enhance the safety program, but it does breed complacency among those directly responsible for taking immediate priority action to correct these discrepancies.

An effective commander will use his safety officer as an extension of himself. He is the commander's eyes and ears for safety; he has the responsibility to point out hazardous conditions to the commander. No one wishes to be a party to an accident or the agency that permitted an injury to occur. With the pressures of maintenance, operational commitments, et cetera, it takes a separate staff member to monitor all staff functions to insure that these tasks are being accomplished.

A prime requisite of a commander is to recognize what a safety officer worth his salt can do for his organization. You can bet money, marbles, or chalk that back of a good unit with a good commander is a good safety officer.

The job of a safety officer is one dealing with intangibles. It is mainly a function of selling one's self. If the job is done right, there are no statistics to show how many accidents were prevented or how many people weren't injured! Proper plaudits are few and far between, but the practice of condemning the safety officer for a discovered safety discrepancy when he has done his job, indicates that the discoverer isn't doing his job. If the safety officer hasn't pointed out the discrepancy, hasn't brought it to the attention of the proper corrective authority, hasn't done what he can to get it corrected, then fine, put the "monkey" on his back! BUT, if he has done all he can, then the responsibility should be placed where it truly belongs. Even if, in answer to the report write-up, the responsible agency corrects the discrepancy, nobody remembers the horse that ran second. They only remember that the safety program was written up or briefed as "running at slow speed." The safety officer and his people then have a tougher nut to crack — for who listens to a loser?

Inspections, surveys, staff visits are fine management tools. The old bit about "not seeing the forest for the trees" sometimes is true. A different viewpoint, another interpretation, a cross-talk from experience, a passing-on of how comparable units operate, or a "nuts and bolts" inspection — are all beneficial if accepted in the intent given. However, they must be accurate and attention focused on true causes, not generalized or lumped into a catch-all just for the sake of expediency.

We must support the safety officer and his people. Who knows all the mishaps that have not occurred because they have done their job? They must have the backing of all of us and the continued green light to carry on their most needed services. ★

Missilanea

WATCH THOSE CONNECTIONS – Every missile system in the Air Force inventory has had its share of troubles with electrical connectors, due principally to the presence of moisture, foreign matter, or bent pins. AFM 127-201, Missile Safety Handbook, pages 8-16, states:

"28. Connectors will be examined (before mating) for dirt, moisture, excessive solder, corrosion, metal filings, breaks, and bent pins. The parts of the connector will be wiped carefully before mating. When not in use, they will be capped or covered.

"29. Connectors will not be unduly forced to mate since forcing may bend pins to positions in which short circuits will occur. Mismating or using oversized probes will be avoided since pins may be bent or the socket holes enlarged."

TO 21M-LGM-25C-2-9 goes even further, with requirements which could be applied to systems other than Titan II. The TO requires that all electrical connectors be inspected and purged by:

- Using a magnifying glass and extension light to inspect electrical connectors for foreign material (especially metallic particles), corroded or bent pins, pin hole damage, evidence that connector was wet, and physical damage.
- Replacing damaged connectors; on ordnance items, the entire item will be replaced.
- Cleaning dirty connectors, other than ordnance items, with a lint free cloth or a brush. If this is not satisfactory, they will be blown out with compressed nitrogen gas.
- Removing dirty connectors on ordnance items and cleaning them in the surveillance and inspection area.

Most of the problems experienced with electrical connectors can generally be eliminated by diligently following the above cited instructions. To do so requires little added effort, since it only involves the practice and development of good work habits. It could result in greatly reduced incident and hazard reports.

Willie Hammer
Directorate of Aerospace Safety

PERSONNEL ERROR vs. SUPERVISION – The lack of supervision is probably one of the greatest causes of personnel error and can be categorized into crew member error, maintenance error, and supervisory error. In 1964 crew member error was responsible for only about seven per cent of all accidents in air-launched missiles; maintenance was charged with 26 per cent of all accidents in surface-launched missiles, and supervision was the cause of five per cent of all accidents in surface launched missiles.

Personnel error is the one area where Wing and Squadron Commanders can and must assert themselves. Supervision is the tool they can best employ to combat personnel error. It is a proven fact that aggressive leadership and command interest produce lower accident rates. However, each year, the number of accidents attributed to supervisory error increases. Does this mean that the quality of supervision is less effective today than it was in the past? Actually, the reverse is true. We have learned to more readily recognize poor supervision as an accident cause factor.

Supervisory inculcation of proper policy and procedure is the answer. Frequently, it is difficult to determine supervision as the true cause factor in a particular accident or incident, yet it could have been prevented by adherence to established policy and proper current procedures.

As equipment becomes more complex, results of accidents prove to be more serious and costly. The trend can be expected to continue as man's quest for more sophisticated systems dictates even more pressure on operations, maintenance and supervision.

As reflected by the above referenced percentages, errors on the part of maintenance personnel do cause accidents. Most causes of materiel failure can be traced to human oversight or, in retrospect, lack of foresight. Some materiel deficiencies may not be the direct result of human error, but warnings of an impending mishap are generally evident—if only the signs are recognized. Operational hazard reports, incident reports, missile hazard reports, and AFTO Forms 22 are tools which should be used by supervisors to identify these warnings. If properly evaluated, these reports signal an impending accident; however, they are not the only source of warning signs. Materiel failure data, if viewed from a safety standpoint, will serve the same purpose. Agencies charged with support and design functions can be most effective here.

Emphasis on supervision down to the lowest level is the answer to reduction in our accident/incident rate. Recognize this fact and errors will decrease!

Major R. L. Mahynske
Directorate of Aerospace Safety

WHERE ARE THE WHITE SCARFS?

Maj Russell S. Buker, USAF Aerospace Pilot School, Edwards AFB, Calif.
(Reprinted from USAF Instructor Journal, Hq ATC)

The white scarf and goggles with a side order of champagne and women has been the standard Hollywood version of a test pilot since the days of Clark Gable and Spencer Tracy. The late-late movie still features these two drinking and loving their way through dangerous test flights, and people must wonder why there is so much training and experience required to become an astronaut.

This Hollywood version of a test pilot never did exist and anyone who visits the Aerospace Research Pilot School (ARPS) at Edwards AFB, California, knows why. They will see here a group of dedicated young men, with at least a bachelor's degree in an engineering science and 1500 hours of flying time, learning how to become test pilots. They will also see them spending 12 to 14 hours a day working to complete a 12-month course that consists of approximately 600 academic classroom hours and 400 flying hours. Obviously then, there is a vast difference between the celluloid test pilot and the aerospace student who will be tomorrow's astronaut.

The Aerospace Research Pilot School is a unique institution that trains Air Force, Navy, NASA, NATO, and civilian test pilots. It consists of the Experimental Test Pilot Division and the Aerospace Research Pilot Division. This article will feature the mission of the Experimental Test Pilot Division which comprises the first six months of the course.

The Experimental Division is a slightly compressed version of the old Test Pilot School that was founded in 1941. Colonel Chuck Yeager is a graduate of this early course and is now the commandant of the school. His highly qualified staff consists of graduates from the school (top 10 per cent of their class) with engineering degrees, and average of 5000 hours of flying time, and flight test experience in development programs including the T-38, F-101, F-104, F-106, B-58, C-141, and many others.

TRAINING TRANSLATORS

The job of the Test Pilot Division consists of converting a pilot who has an engineering degree into a qualified engineering test pilot. This may seem a straightforward job on the surface, but there is a large difference between the two. The main problem is communication, and it may be said that the first six months of the course is spent teaching these pilots a new language. They have to be able to tell a design aeronautical engineer what is wrong with the flight characteristics of an aircraft in *his* language, and at the same time be able to explain highly complicated mathematics in language that a squadron pilot will understand. The job, therefore, is to bridge this gap and have one person that can test fly the aircraft and discuss its aerodynamic characteristics with either an engineer or another pilot.

The instructor's classroom is unique. He teaches on the chalkboard and in the cockpit. This is different from any other flying school in the Air Force, where academics and flying are taught by separate instructors. It is the predominant factor in the success of the school and the reason it produces outstanding graduates. The ability to demonstrate under actual conditions the highly complicated mathematics discussed in the classroom is a valuable tool that instills confidence in the student. It also enables the instructor to see if his lectures have been effective, and points out areas that need more emphasis.

There are three factors that make a good test pilot. First, he must

Training takes many forms: celestial navigation, classroom, flying, space flight simulation. Reward may be future trip to the moon, even the planets.

have a complete understanding of airplane aerodynamics. These principles consist of the performance of an aircraft (takeoff, climb, cruise) and the basic stability and control characteristics (handling qualities, maneuverability, control system harmony and ability to perform the mission). Second, he must have sound judgment in order to plan the mission properly and acquire the most data possible with a high degree of safety. Finally, he must be able to perform the complicated flight test techniques that are used to collect data. This seems to indicate that almost any Air Force pilot could qualify for the job if he spent some time studying aerodynamics, but this is not true. It is true that Air Force pilots have sound judgment and are precision flyers, but the present system of training pilots and using them later in operational squadrons does not lend itself to individual thinking. Today, pilots learn how to fly using the same method they did in grade school to learn their multiplication tables. In fact, before a pilot can check out in an aircraft, he has to be able to parrot emergency procedures verbatim in order to pass the written test that allows him to start flying the aircraft. Furthermore, if he encounters an emergency after he has checked out in the aircraft and does not handle it in the prescribed manner of the checklist, he is open to criticism and possible reprimand.

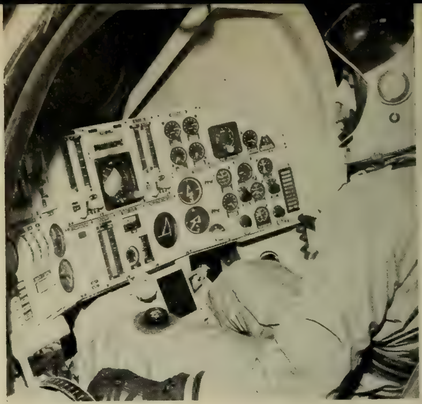
THE "SCHOOL SOLUTION": *WRITE* THE BOOK!

This type of training is not conducive to testing aircraft. Many times the checklist has not been written. Emergencies have to be handled by the pilot because of what he knows and not "by the numbers." This means that one of the primary steps is to have the student realize that there is no "school solution" to most of his problems. The solution to a flying or academic problem has to come from his knowledge of the system involved and not from the book. In fact, his job after graduation will be to *write* the book on the aircraft that he is testing. This places a great responsibility on him, so from the start of the course he is constantly placed in pressure situations that will *make him think.*

The first three months are devoted to the performance testing of aircraft. It consists of teaching the academics of lift curves, shock waves, and engine theory. The flight test techniques that accompany this theory define the performance flight envelope of the aircraft. The exploration of this envelope is performed by moving from point to point. It does not consist of taking an aircraft to its maximum altitude and airspeed on its first flight. In fact, the first flight on a new plane is usually composed of a takeoff and landing. No new flight is planned until the data from the previous flight have been examined and it has been determined beyond a shadow of a doubt that it is safe to continue. This is where good judgment and maturity are required, and snap decisions are not tolerated. The point by point progress of the X-15 test program and the current space program are good examples of this principle. This fantastic success and safety records of these programs attest to the veracity of this method.

The requirement for precise flying is also stressed at all times, since data gathered have to be obtained under perfect conditions. It is sometimes required to stabilize the aircraft at one altitude and one airspeed for two minutes or more in order to record accurate rpm, fuel flow, and engine temperatures. These data are used to determine the best cruise power for cross country flying. Another test requires that the aircraft be placed in a turn at full power holding a constant airspeed and altitude. The resulting data are used to determine the turning performance of the aircraft, and requires extreme precision.

Stability and control is covered in the second three months. It teaches the student how to determine good and bad handling quali-



Major John Prodan operates the complex controls of the T-27 Space Flight Simulator at the Aerospace Research Pilot School.

ties of an aircraft. The squadron pilot usually takes what has been designed in an aircraft control system and spends most of his time getting used to anything that is unusual. An extreme example of bad control design would be to have a pilot pull on the stick to go down and push to go up. This would be intolerable of course, but nevertheless *could be adapted to* by a pilot. Another discrepancy would be to have a 5-pound force required to move the elevator surface, and at the same time have a 10-pound force put the aircraft in a four g pull up. These examples are ridiculous, yet designs almost as bad as these have been found in some aircraft and test pilots have refused them.

Another area taught in stability and control is the proper way to conduct a spin program. Most modern aircraft have poor spin characteristics. The academics involved are highly complicated and involve algebraic equations describing six degrees of freedom. The equations can be used to predict the proper control positions that should be used to effect recovery, and are a highly useful tool. The proof of the equations can only come from flying the aircraft and actually trying them out. The student uses the academics to determine the best recovery procedure for the T-33A and then flies a test program in this aircraft to determine the spin characteristics and best recovery characteristics for that aircraft. He is taught the safe way to approach a dangerous test program such as the spin test. He also learns to be able to verbally describe the spin characteristics of the T-33A which include altitude lost per turn, time per turn, airspeed change per turn, and general aircraft gyrations during the spin.

Picture yourself in the cockpit of a T-33A in a spin that is rotating one turn every four seconds and try to read the altitude, air speed and time at the end of each turn *plus* remember the various gyrations that have gone on during the turn. Add to this the responsibility of having to write a report that would be used to put the procedures you have developed for recovery into a publication for all of the pilots in the Air Force to read and use, and you have an example of the pressure that the student is under every day!!

The final result of all of the data collected both quantitatively and qualitatively is presented in a formal, published technical report. This is the portion of the course that takes the extra two hours per day. The student is required to interpret all the data he has collected, either by photo panel or oscillograph, reduce it, and present it on appropriate plots. He is also required to discuss these data and present his opinion on the performance and handling characteristics of the aircraft that these data describe. There can be no areas where the discussion disagrees with the data. This is where the student learns that he must be consistent in what he says and what the data show. He has to track down any discrepancies and be completely convinced that he is right. He also finds that precision flying helps his analysis and presentation, since poor gathering techniques lead to poor data and inconclusive results.

When the student has completed the first six months of the course he has been exposed to approximately 20 areas of flight testing. He has had to plan and execute complicated missions on a limited fuel supply and still get all of the data required. During all of this, he has had to maintain geographic orientation, and look out for other aircraft. He has had to handle simulated emergencies and finally, worry about a grade on the flight from the instructor in the rear seat. After the flight has been completed, he has to reduce the data, present it in a written report and receive a grade for this. He has had daily pop quizzes to contend with, and a weekly 2-hour quiz which covers all of the academics and flying theory that has been presented that week. Finally, most of the students have to go home to a wife and family and try to solve those problems, too!

Though the demands upon ou students are great, it should be noted that the reward for this hectic six months is also a large one: the test pilot is now eligible for a mission into space.

Where are the white scarfs? If you bring one to the Aerospace Research Pilot School, leave it hanging in the closet. The job of a test pilot demands hard work and complete dedication with little publicity. The publicity is for the Hollywood actors. ★

WIND GUSTS

Maj Thomas J. Slaybaugh, Hq USAFE

Leafing through 1964 aircraft accident briefs we were struck with the number of times and the number of ways in which surface wind gusts had played a part in aircraft damage. Thinking we might do better in the months ahead if we were to emphasize this problem, we recount problems of 1964:

Let's start with the Gooney Bird. I suspect that a brief like this could have been written at least once every year since we've had this old Air Corps standby:

Training. GCA Approach. Gusty winds and turbulence reported to pilot. Pilot allowed aircraft to touch down in overrun. Aircraft made two 360 degree turns before coming to a stop. It's opinioned the primary cause stemmed from the pilot's failure to maintain adequate airspeed. The gusty winds are given a contributory assist as is the copilot for failure to monitor the airspeed and warn the pilot.

Picture the rodeo-like gyrations on this one: A B-47 jock bounced on his bird on first try and started a go around. Next touchdown was right wing first, followed by a veer off the runway into parked aircraft. The 12 knot crosswind was given as contributory.

A B-52 pilot undergoing upgrading training was about to make a nose low touchdown. The IP took control, but the aircraft hit and bounced. A landing gear failed in this accident, due to materiel fatigue, a hard landing and gusting winds.

There was one case in which surface winds for the incoming storm were forecast to be below evacuation limits. The forecast was correct. The tied down aircraft rode out the winds, but a nearby building didn't fare so well. Pieces blew off, damaging the tied down aircraft.

In another case people with a need to know didn't get the word. The base ops officer failed to insure proper dissemination of a severe weather warning, aircraft were not adequately tied down and 90 knot winds blew an aircraft into a fire truck.

And weather doesn't stick to the rules. Three aircraft were damaged when thunderstorm winds exceeded forecast velocities and two aircraft were blown into a third.

Neither the pilot nor flight engineer of a transport completed the checklist prior to leaving the aircraft. The aircraft was not properly secured and later was blown into a civilian transport.

A sudden, violent gust of wind damaged controls of a parked aircraft.

An accident occurred during an attempted go around after a downwind, crosswind touchdown on an icy runway. The dangerous landing conditions had not been passed to the pilot by supervisory personnel.

Touchdown was 12 feet short, three feet below runway level when the aircraft stalled in gusty wind conditions.

Gusts of at least 72 miles per hour during a thunderstorm caused aircraft to jump chocks and collide with other aircraft and flight line buildings.

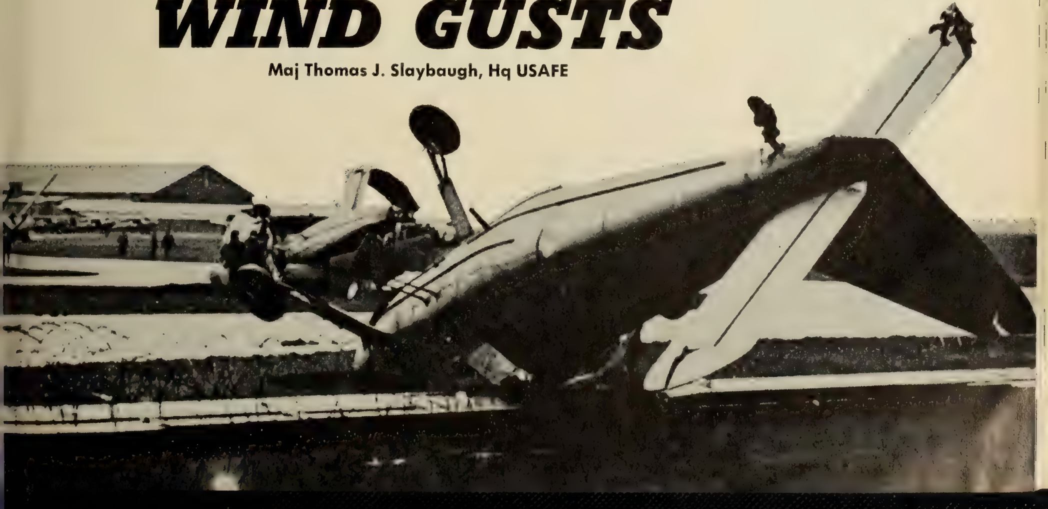
Despite reportedly adequate tiedown measures, an aircraft was damaged when a hurricane struck a base.

A jet fighter jock failed to heed the minimum control speed warning, got too slow during a crosswind landing and lost control.

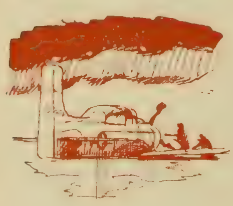
And sometimes it is the other guy's fault. One of our aircraft was damaged when a taxiing civilian aircraft was blown into it.

Well, there you are. Obviously, from the 1964 experience, we have a wind vs. airplane problem. Here are some old, old suggestions — still good.

- Get the wind word out and take precautionary measures as necessary.
- Land on runways most nearly aligned into the wind — shouldn't be the pilot's headache, but if you don't like what the guys in the high glass house select for you, make 'em change it. If you don't hack it, *you'll* get the scratches and primary blame.
- Follow Dash One procedures as to amount of flaps, adding one-half the gust factor to your airspeed, etc.
- If the airplane starts flying you, cob it and go around.
- Don't land or takeoff with a thunderstorm over or adjacent to the field.
- Stay alert! Think of what you're doing now, not what you did last night, or what you hope to do tonight.
- Don't experiment — go to an alternate. ★

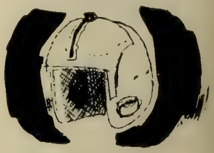


Aerobits



CHECKLISTS. Checklists are sometimes annoying, but, over the years, we've found them to be necessary. The human mind just doesn't always remember every item of a particular procedure. Case in point: An A-1E pilot attempted to take off with rudder gustlock in place. The pilot received second-degree burns in the ensuing fire, and the aircraft was seriously damaged. Item 8b2 of the Exterior Inspection checklist is *"Remove gustlock."*

CLIPPED — After an engine flamed out in flight, an investigation turned up an unidentified metal object fused to the fuel shutoff terminals. Some research revealed the object to be an earphone cord hold-down clip from an HGU-2A/P helmet. When a check around the base was made it was found that a number of these were missing from helmets and that probably many of them were being lost in cockpits. How's the clip situation at your base?



TWO LOW PASSES—Aviation history is liberally sprinkled with the exploits of military pilots who have flown, or attempted to fly, under bridges, down the main street of the old home town, along the beach for the benefit of the bathing beauties and last but not least, victory rolls at minimum altitude. The majority of these pseudo-heroics escape detection since they go unreported. The following accident brief is a classic example of a willful violation of both regulations and good judgment. This incident was well publicized because a million-dollar fighter and two fighter pilots went down the tube. The accident board recommended that this mishap be brought to the attention of all USAF pilots through publication of a brief in AEROSPACE SAFETY.

The accident investigation revealed that the crash site was near the home of the front seat pilot. Moreover, the wife of this pilot observed the crash. At the time of the accident she was riding a horse in an area close to her home.

The widow said that the aircraft made two low passes and crashed on the second one. Other witnesses confirmed the low passes and loss of control. Further questioning revealed that this pilot had made it a practice to fly by his home. He had done this at other bases in various types of aircraft, solely to impress his wife.

It is most unfortunate that these other occasions went undetected or unreported. A stiff reprimand for one of the earlier violations might have created a lasting impression and cooled his desire for flat-hatting.

What did he gain by a low pass in an unauthorized area? Nothing! What was lost? Two lives!

Violations of flying regulations must be handled severely by all commanders. We cannot condone the loss of valuable aircrew and aircraft, especially when they are the result of adolescent impulses.

Lt Col Eugene P. (Gus) Sonnenberg
Directorate of Aerospace Safety

BOOT CATCHER — Insignificant things sometimes cause one heck of a lot of trouble. A while back a pilot reported the heels of his boots were binding on the rubber matting installed under the rudder pedals. The matting was there to provide a nice appearance and to protect the paint on the metal under the pedals.

With his feet on the brakes, this pilot experienced no trouble, but when he moved his feet down on the pedals the binding occurred. After the rubber was removed, the pilot's feet slid back and forth okay. The organization that owned this airplane, a '135, removed the rubber matting. However, we're passing this on as a warning in case someone decides to dress up other birds with similar material.

PAY ATTENTION—Lack of attention was responsible for a couple of recent incidents, neither of which developed into anything serious but which adequately points out that a moment of inattention might be disastrous.

- A T-33 flamed out. The pilot descended to FL 200, got a restart and completed the flight successfully. What happened was that the pilot allowed the fuselage tank to deplete and neither the pilot nor the navigator noticed the tip and fuselage low level lights come on (the pilot had dimmed them prior to flight). Fatigue was considered to be a factor since the pilot had only three hours sleep before the flight, after working a full day and flying to a staging base.

- During penetration to a GGA downwind the crew of a B-52 was advised of another aircraft in the area at an unknown altitude. Copilot in the left seat called for flaps down but the IP, sitting in the copilot's seat, leaning forward to scan for the other aircraft and talking on the radio, moved the drag chute lever instead. The gunner announced chute deployment and it was jettisoned before becoming full open. Cause: IP preoccupation.

CHOPPER WRECKAGE—The accident scene was indeed unpleasant. Wreckage of an H-3, almost totally destroyed by fire, was located less than 300 feet from the point of liftoff. Looking at the wreckage gave me that sick feeling in the pit of my stomach which soon turned to amazement and then relief to know there were no fatalities.

My purpose for being at this holocaust was to help determine what caused it so that the same catastrophe would not occur elsewhere. Upon looking at the surrounding area, my immediate concern was directed toward the helipad from which the unfortunate flight originated. Not only was it marginal in size for a large twin-jet helicopter, it was not stabilized to prevent FOD; it had obstructions (such as hills, chainlink fence, high-tension lines, poles and antennae) and ditches adjacent to all sides.

Combined with the high elevation, variable wind currents around the steep, sloping hills, and maximum performance takeoff requirements, operation from this helipad demanded perfection in every respect. Yet the mission—transporting passengers and cargo to and from a launch facility—was considered routine. In this instance, rotor decay occurred almost immediately after the big helicopter lifted off the pad, and there was no place to set it down safely. Thus, the Air Force lost a $750,000 aircraft and several of its airmen were injured.

My reason for bringing this accident to your attention is to suggest a closer look at the conditions under which you are operating. Fixed-wing aircraft are not routinely operated from runways that require maximum-performance takeoffs on every departure; *let's expect the same margin of safety for our rotor-wing aircraft.*

Lt Col Robert E. Englebretson
Directorate of Aerospace Safety

Aerobits

STUBBORN CUSS, WASN'T HE?—How often have you heard the term, "he was an accident looking for a place to happen?" Especially after the guy pranged the machine and the word was out that all was not well, that the investigation brought out irregularities in procedures, training, compliance with directives, and so forth. In other words, the accident happened because people goofed.

Now, it is probably safe to assume that all of us in the flying business have at one time or another been in the category of "an accident looking for a place to happen." Those who have profited by the forgiven mistakes can undoubtedly pass on experiences to those who are just now, or have in the recent past, chosen military aviation as a career. But, what about the lad who doesn't seem to profit from his, or the mistakes of others? What about the guy who's too stubborn to see the light? What about the individual who has just recently survived a situation that could have been disastrous, perhaps not to his physical being but most certainly to his professional well being.

Take the case of a 29-year-old Air Force captain with about 1800 total flying hours accumulated during the past seven years, who was taxiing a C-54 when hydraulic troubles developed. According to the incident report, nosewheel steering was lost just after the aircraft had landed and cleared the active runway. *The pilot continued taxiing, using brakes for steering* (perhaps this was a fall-back to most of his experience which was in single engine aircraft without nosewheel steering available). Then when Nr 2 engine began leaking hydraulic fluid, he shut the engine down but *continued taxiing!* After he turned into the parking area brakes were "suddenly" lost and effective steering could not be accomplished with differential power. Finally, to avoid collision with three parked fighter aircraft, the emergency airbrake system was activated and the aircraft stopped.

Investigation revealed a ruptured hydraulic pressure line on Nr 2 engine which caused complete depletion of the aircraft hydraulic system. Corrective action required replacing the pressure line, purging the brake system, and reservicing the hydraulic system. After this, the mission continued. Incidentally, the mission was a passenger and parts pick-up at the base where this incident occurred.

Now the questions begin: Has this pilot profited from this experience? Does he fully comprehend the cause? Does he understand his mistake? Does he appreciate his good fortune? And many others equally appropriate. If the answers are affirmative, it seems logical to conclude that the Air Force has probably gained a wiser pilot whose future should be brighter. But, if the answers are in the negative, this lad may become one of those accidents that found a place to happen.

Whether it was stubborness, bad judgment or ignorance which caused this pilot to continue taxiing in spite of all indications that the aircraft should have been stopped as soon as nose steering was lost, it is hoped that the pilot benefited from this experience. It is also hoped that the pilot's organization is not responsible for generating pressures that would cause a man to ignore operating instructions for the urgency of a low-priority peacetime mission. And finally, it is hoped that standardization in this pilot's unit is of the caliber that would not only identify but correct unsafe practices such as this. In any event, publishing this unheralded event should serve as a reminder to both new and old heads that the incident which goes almost unnoticed may well be the indicator of a catastrophe to come. ★

Lt Col James S. Keel
Directorate of Aerospace Safety

☆ U. S. GOVERNMENT PRINTING OFFICE 1965 201-211/2

WELL DONE

CAPTAIN ROBERT J. O'GRADY

482 FIGHTER INTERCEPTOR SQUADRON, SEYMOUR JOHNSON AFB, N.C.

Captain Robert J. O'Grady was scheduled for a routine maintenance test flight in an F-102, following completion of a periodic inspection.

Preflight, emergency fuel check, runup and takeoff were satisfactory. The climb to altitude, including ascending checks, was uneventful. At 26,000 feet, approximately 16 miles south of the base, Captain O'Grady proceeded with the emergency fuel check by retarding the throttle and switching to emergency fuel. The engine immediately flamed out. Repeated airstart attempts in both emergency and normal systems were unsuccessful during the glide toward home plate. Immediately after flameout Captain O'Grady advised Seymour Johnson Tower of his emergency and declared his intention to land from a flameout pattern. At 16,000 feet over the field, the gear was extended and checked. Additional airstarts were attempted without success. At low key, the ram air turbine was extended while the pilot maintained 220 KIAS. Further airstart attempts were discontinued in order to concentrate on final approach positioning and touchdown point. Airspeed was reduced to 200 knots prior to flare. A smooth touchdown approximately 1200 feet past mobile was accomplished, the drag chute deployed, and landing roll out completed.

Investigation disclosed that the engine fuel control had failed during the changeover from the main system to the emergency system.

The professional skill and superior flying ability displayed by Captain O'Grady, coupled with his accurate analysis of the problem, enabled him to successfully handle this emergency. WELL DONE! ★

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UNITED STATES AIR F

DECEMBER 1965

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AFRP 62-1 DECEMBER 1965 VOLUME 21 NUMBER 12

FALLOUT

HOLDING PATTERN ENTRY

Reference POINT TO PONDER (The IPIS Approach, pg 9) in the September issue.

After spending many years as an Instrument Flying Instructor, it was difficult to stomach the "no brains" type holding pattern entry implemented in the late 1950s. The gimmick suggested in POINT TO PONDER as "a convenient method to determine holding pattern entry" parlays the "no brain" into absurdity and could cause complacency that would lead to disorientation. It is this type of crutch that we must not allow to creep into our procedure in order to maintain our professionalism and aerospace safety.

Maj Henry DeGraa
NSALO, AFETR
Patrick AFB, Fla

Following is a reply from the USAF Instrument Pilot Instructor School (ATC):

"The technique cited was developed here in the School and is presented to each student for his acceptance or rejection during the course of training. Every class of students must be out of step with the Majo since they enthusiastically accept and use the technique!"

DID YOU KNOW THAT . . . ?

Here is an item I believe would be o interest to others as it explains one use o the computer which is not clearly defined i other publications:

Did you know that the answer to the question "am I still on the airway?", i readily available on the back side of you computer? Simply note the number of degrees the VOR/TACAN needle differs fro the published airway course and set thi figure in the drift correction window. Nex read your DME (or use DR mileage) an opposite this mileage figure on the minute scale, read the number of miles from th airway centerline on the miles scale. Fo example: set 5 degrees in the drift correction window, then opposite 45 NM (minutes scale), read 3.9 NM (miles scale) fro the airway centerline. (This is just withi the established airway width of 4 NM fro the published centerline.) This computatio is most useful when flying at minimum en route altitudes over mountainous terrai and especially after switching from an outbound track to an inbound radial that ma differ several degrees due to local magneti disturbances.

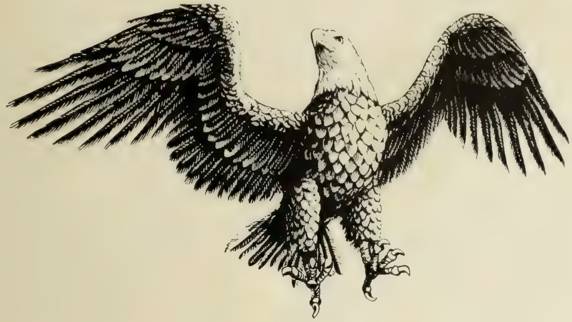
Lt Col Ernest E. Bradley, Jr
Hq USAF (AFOAPG)
Washington, D.C.

MISREADING THE ALTIMETER

These are my comments on the subjec covered in your fine article "How High Up?", in the September issue.

Using the F-100 as an example, sinc

continued on page 25



Maintaining A Ready State

A large segment of our national resources has been dedicated to the development of the most formidable aerospace force ever known. The Air Force is largely responsible for keeping this force in a ready state – capable of reacting reliably to support national policy requirements and the needs of our people.

The ready state of this force demands both effective equipment and peak efficiency from crew, maintenance and support personnel. More is needed. Everything possible must be done to preserve the ingredients that make up this force. The destruction of even one piece of equipment or the loss of a single airman degrades our capability irretrievably.

We can anticipate an even greater need of air power during the year ahead. Now is the time to take another look at the state of our safety. What has been done to prevent accidents is important. Equally or more important is a conscientious self-evaluation to learn what still remains to be done.

The President has established "Mission Safety–70" – a five-year accident-prevention goal. We in the Air Force must support this goal in every quadrant: nuclear, aircraft, missile and ground safety. These programs have achieved commendable gains in accident prevention, gains which are a product of the professionalism and dedication displayed by the entire Air Force – officers, airmen, civilians and families. These programs must be continued and accelerated to meet the increasing demand on the nation's air power in these critical times. ★

Glen W Martin

GLEN W. MARTIN
LIEUTENANT GENERAL, USAF
THE INSPECTOR GENERAL

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

U.S.AIR FORCE
USAF

ICE CRYSTALS

. . . AND FLAMEOUTS

Lt Col Norman H. Frisbie
Directorate of Aerospace Safety

The following is a narrative of three test F-4C aircraft flown from the McDonnell Aircraft plant at St. Louis, MAC 876, MAC 1054 and MAC 1050:

On Thursday, 1 July 1965, at 0940, the three-plane flight took off from MAC, St. Louis, and climbed initially to an altitude of about 37,000 feet. An overcast was encountered at 20,000 feet; upon leveling off, the aircraft were still in the clouds. Climb was made to higher altitudes, MAC 876 to 42,000, MAC 1054 to 40,000 feet, and MAC 1050 to 38,000 feet. All aircraft were still in the clouds. After approximately 10 minutes at these altitudes, the following sequence took place: MAC 1054 had a flameout of the port engine; MAC 1050 lost his airspeed indicator; and MAC 876 experienced a double flameout.

MAC 1054 was flying at 40,000 feet at .9 IMN (indicated mach nr.) with approximately 90 per cent rpm. The pilot saw what he thought was visible moisture hitting the windshield prior to the first flameout. When the port engine flamed out, the pilot immediately advanced starboard throttle to full military and reported that EGT settled down at 625 degrees.

The port throttle was then retarded to idle detent and ignition was depressed. Relight was obtained at 60 per cent rpm. After 30 to 60 seconds the engine flamed out again. Another relight was obtained and this too lasted only for 30 to 60 seconds. Both of these relights and flameouts occured at 40,000 feet. In both cases the flameouts occurred after the engine had been relit and brought up to a stabilized 90 per cent rpm. After the third flameout the pilot felt that he was very slow, even though his airspeed indication had not dropped. Cross checking the angle of attack showed it was around 22 units. (Cruise is about eight units, approach at 19 and full stall at 30 units.) This confirmed that his airspeed indication was erroneous.

The pilot declared an emergency and pushed over to start a descent, using the angle of attack. At the instant of push over he felt the rudder shaker (a stall warning vibrator set at 22.3 units of attack), and his airspeed indicator unwound to zero. Pitot heat had been placed in the "On" position prior to encountering IFR conditions during the initial climbout. While pushing over, the third relight was made and this time the engine kept running for the rest of the flight. At no time during the flight was ice seen on any external surface.

Right after MAC 1054's initial flameout, MAC 1050 lost his airspeed indicator. When this occurred, pitot heat was turned on, a descent was started and the aircraft returned to base.

At about the same time that MAC 1054 was having his flame-

ICE CRYSTALS
. . . AND FLAMEOUTS

out difficulties, the first aircraft, MAC 876, experienced a double engine flameout. This aircraft was flying at 42,000 feet at .9 IMN. Both pitot heat and engine anti-ice had been placed in the "On" position before encountering IFR conditions in initial climbout. MAC 876 had reduced power on both engines to 2100 pph (pounds per hour) in order to slow down from .9 to .85 Mach. Although rpms were not noted, a fuel flow of 2100 pounds at 42,000 feet is equivalent to 90 per cent rpm. It was during this deceleration, at .87 IMN that dual flameout occurred. When this happened a descent was started and both throttles were immediately brought to idle. The port throttle was then placed in the cut-off position and the starboard throttle was pumped once toward military to be certain the flame was out. There was no response to this action, so the starboard throttle was placed in cut-off position. Intake ramps were checked visually and found to be operating normally. The pilot stated that the aircraft did not have any visible ice on any surface throughout the flight. Both throttles were then advanced to idle detent and ignition buttons were depressed. Port engine light off occurred at about 40,000 feet and starboard at about 37,000 feet. Relights were obtained before generator drop-out. After the engines relit, speed was allowed to build up and final recovery was made at 34,000 feet at .9 IMN. The pilot then returned to base and landed.

Temperature at 40,000 feet was minus 57 degrees C and visible moisture was present. Flight was in cirrus clouds. Turbulence was very light and flight was in the vicinity of a known wind shear. Thunderstorms were reported in the vicinity immediately after the flameouts.

MAC Investigation

During the investigation no malfunctions were found that could be pointed to as the definite cause of these flameouts. It should be noted that one of the pilots thought he saw visible moisture hitting the windshield prior to the flameouts. The moisture, it is believed, had to be ice crystals rather than super-cooled water. Each pilot specifically stated that the lips of the intake ducts were checked and found to be free of ice. These surfaces will be among the first to build up ice in the proper atmospheric conditions, and the fact that they were clean further substantiates that the moisture was in the form of ice crystals.

The foregoing investigation failed to reveal conclusive evidence of mechanical failures which could have caused or contributed to the flameouts.

The prevailing atmospheric conditions do indicate strongly that the flameouts were induced by ingestion of ice crystals.

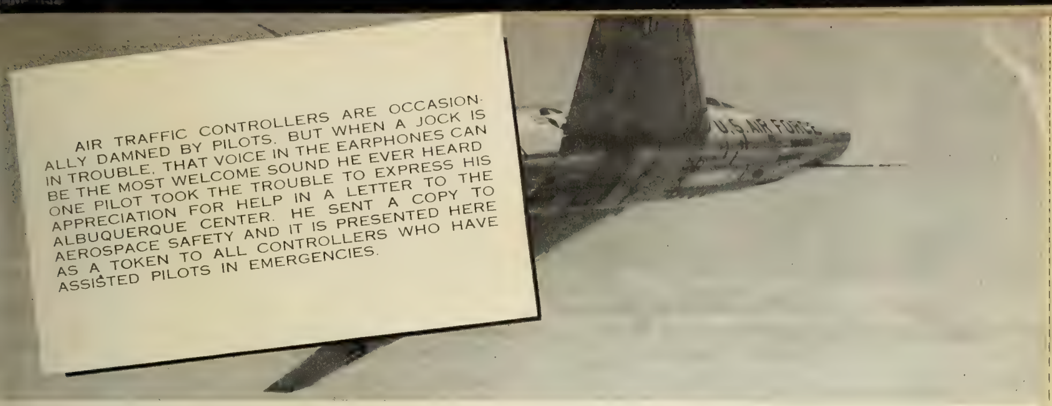
Aerospace Systems Division (ASD) flight test people at Wright-Patterson also have the problem under surveillance and have been conducting F-4C engine icing tests. They have been flying behind a KC-135 spraying water in freezing temperatures which, quite naturally, loads up the F-4C with enormous amounts of ice. So far, an informal evaluation of this test indicates that rapid movements of the throttle produce flameouts. ASD will issue supplements to the F-4 manuals and will continue the investigation as this phenomenon affects all aircraft. If any pilot knows of similar incidents such as described above, let ASZME at Wright-Patterson know.

We in Safety have made the following evaluation:

- Weather: It can be assumed that almost all clouds at high altitudes are of ice crystal content. The amount of ice crystal content varies with cloud type — translucency is the key. The more transparent formations contain fewer ice crystals. Thunderstorm clouds and clouds associated with thunderstorms (in the higher levels such as cirrus clouds) should be assumed to have high ice crystal content, although thunderstorm tops frequently are of super-cooled wate content and to a lesser degree ice crystal formation. High level cirrus clouds associated with frontal activity can also be assumed to have high ice crystal content. However the amount of ice crystallization in such clouds necessary to cause flameouts is so rare that we do no believe this problem, per se, exists. This opinion is supported by only three other reported occasions once by B-52's, once by an F-102 and by three Navy F-4B's in 1961 Forecasting amounts of ice crystallization is impossible.

- Pilotage: Based on limited incidents, Directorate of Aerospace Safety recommends that crews be made aware that these unexplained flameouts did occur and that no mechanical malfunction was found on either the airframes or the engine which could be considered a contributing factor. When practicable high performance aircraft should avoid flying in heavy or dense cirrus. If avoidance of this type clouds is impracticable, crew should realize that relights normally constitute no problem and that the area of high ice crystallization is limited to a very narrow band in the atmosphere. In al probability, a lower altitude wil have to be selected in order t main the light.

In summary, forewarned is forearmed. The problem discussed i rare, but if it happens to you, don' panic. Get a relight, select anothe altitude, if possible, and please report the incident. ★



AIR TRAFFIC CONTROLLERS ARE OCCASIONALLY DAMNED BY PILOTS. BUT WHEN A JOCK IS IN TROUBLE, THAT VOICE IN THE EARPHONES CAN BE THE MOST WELCOME SOUND HE EVER HEARD. ONE PILOT TOOK THE TROUBLE TO EXPRESS HIS APPRECIATION FOR HELP IN A LETTER TO THE ALBUQUERQUE CENTER. HE SENT A COPY TO AEROSPACE SAFETY AND IT IS PRESENTED HERE AS A TOKEN TO ALL CONTROLLERS WHO HAVE ASSISTED PILOTS IN EMERGENCIES.

THANKS, FRIEND....

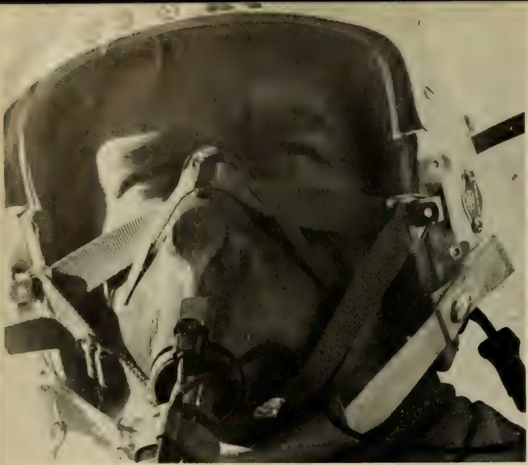
Reference is made to my flight in F-100, serial number 56-3948, 29 July 1965, from Edwards AFB to Holloman AFB. I departed Edwards approximately 1700 MST and arrived at Holloman 1830 MST. The flight was conducted under IFR conditions at FL 370.

Upon departure from Edwards and hand-off to Los Angeles Center, I experienced transmission difficulties; however, I was able to confirm my assigned altitude, FL 370, and clearance to proceed via my filed flight plan. Upon receiving further instructions from Los Angeles Center, I experienced complete transmitter failure. Later I was able to ascertain that my receiver was working, by virtue of hearing transmissions from Albuquerque Center in their attempt to contact me. In addition, at this time I was experiencing flight conditions of heavy turbulence due to numerous thunderstorms in the area. In fact, I could hear Albuquerque Center advising other traffic of severe weather cells and providing them information as to which direction to proceed to eliminate the possibility of encountering these weather cells. Having flown in the military for some 25 years, I naturally thought that my good friends in civilian flying were receiving preferential treatment.

At this time an Albuquerque Center controller, unknown to me, displayed what every pilot in the same circumstances that I was enjoying appreciates. This controller called me and stated that, if I was receiving him, to so indicate by identifying on my IFF. Upon his receipt of my identification from my transponder, he further advised me to change communications channels after which he would try to contact me again, and if he was unable to, I should come back to this previous channel. Upon changing channels again, confirmation of communications was established and at this time and for the duration of the flight I received what I considered VIP treatment. The controller steered me around all known severe weather cells in the area, cleared me through the restricted area 5107 and provided me with approach and letdown instructions to Holloman.

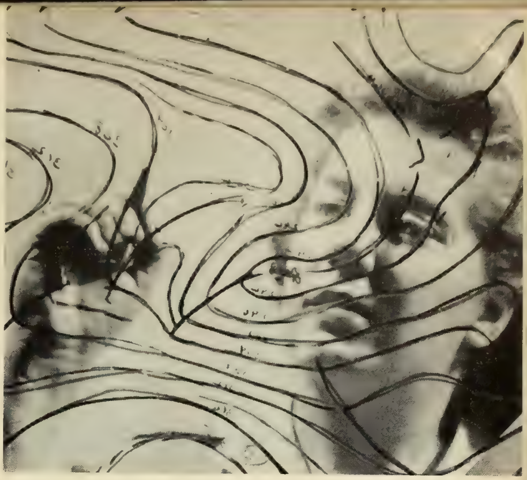
The professionalism displayed by your controllers in the Albuquerque area on this occasion makes it indeed a pleasure to fly a single place fighter with the realization that unusual occurrences in flight are readily apparent to your personnel and they handle them most expeditiously and with the full knowledge of the problems that are presented to the aircrew involved. I wish to personally express my thanks to this specific controller and to your Center for the excellent service they have provided me and my test activities here at Holloman. ★

Col Jack D. Beckelman
Holloman AFB, New Mexico



SOMEONE DOWN HERE

Robert W. Harrison



Flight operations during the winter are no more hazardous than during any other season, but there are peculiarities that must be overcome to make this a true statement. In fact, winter weather with its lower temperatures and fewer thunderstorms brings with it some benefits that offset some of the hazards it presents.

In dealing with winter-provided hazards we can look at them from various points of view, i.e., the pilot's, the operations officer's, the weatherman's, the base engineer's. Weather, existing and forecast, is the concern of all. What's the visibility? What will it be an hour from now, four hours? Runway Condition Reading, (RCR)? Barrier? Is it free and not clogged with ice? How about that cold front? Will the winds be as forecast?

While the pilot has many things to think about in regard to his aircraft, the weather, winter clothing, survival equipment, probably his biggest concern is centered on landing conditions. He will want to know the RCR and how the existing runway condition compares with his landing ability at this weight and configuration. If he can't hack it he wants to know soon enough to get to his alternate. If landing conditions are marginal, he would like to know that, in a fighter, the drag chute is going to operate as advertised, that the barrier is available and ready to stop the bird if necessary.

As for weather reports and forecasts, the pilot wants, needs and deserves to have the latest accurate information. Alternating with those bright, clear days with a hundred miles visibility are going to be some where the weather is in the weeds. When the vis and ceiling are marginal, breakout at 180 knots approach speed will not leave much time for judgment, decision and action. If he's not sharp on instruments, this is no time to practice this skill. This is the time when those hours in the simulator and all those practice instrument approaches will come in mighty handy.

While he has several things going for him – latest weather information, ILS, GCA, VASI – it is a great comfort to know that he can depend upon each and all of them. An unrealistic weather report can lead to an accident, regardless of how sharp the men in the GCA shack are, if the result is a pilot boxed into a corner with no way out except a landing at this base and pretty quick. Seems like every winter one or more unlucky jocks get into this kind of bind and the accident reports sometimes read like a chinese puzzle of ineptitude, confusion and indecision on the part of one or more of the several parties involved.

When these mishaps occur, poor planning often becomes apparent, sometimes compounded by a lack of expertise.

- The pilot can't hack the weather but he discovered this too late and has nowhere else to land, so he keeps trying. Sometimes he never makes it.
- The weatherman missed by a mile. Granted weather forecasting is not an exact science, but this doesn't help the pilot.
- GCA out of commission. Sometimes it takes an awfully long time to turn the van around, or, as has happened, it never got turned, the runway with which it was aligned is the worst available, and its services were of little or no use to the pilot.

Now most of the time the weatherman puts out very fine info. Most of the time radar is right on the money. Most of the time the pilot is sharp and the airplane and all its systems and gages are working as they should. But too frequently when one thing goes sour the old snowball starts rolling and then, look out!

Pilots have been known to squawk before they're hurt. Nevertheless, it behooves all those who support them to do their best, especially when their best may merely make a bad situation tenable. Ops has the responsibility for all flights. To launch or not to launch often is the nagging question facing the Ops officer. Sometimes his decision is a gamble, hedged by the experience of his aircrews, the facilities available and reliance on the weather forecasts. If he's wrong, then it is he who has

to sweat until the last bird is on the ground. Like the pilot, he deserves accurate information as to weather and the condition of all facilities supporting the pilot. He knows that, if he has aircraft scattered at other bases, tomorrow he's going to have scheduling problems. His natural tendency is to avoid this, if at all possible. On the other hand, an accident during a do-or-die attempt to get all the birds back to the home roost is disagreeable to contemplate. Sometime this winter there are going to be several operations officers who will face this dilemma. Their only way out is to know just what they can expect from their aircrews and the support people.

What about the latter. We keep ultimately pointing the finger at those who occupy the support role. We are demanding first class service with an iron clad guarantee to the men doing the flying and those in the office making decisions. Consider the weatherman. He has a big responsibility, and though he is on the receiving end of our ridicule at times, we depend on him one heck of a lot. In fact, we sometimes bet our lives on him. He is, during inclement weather, faced with a tremendous responsibility and even the very best he can do is occasionally not good enough. Weather is fickle, and while generalities in forecasts are pretty accurate, specifics frequently play tricks that, it would seem, could drive a weather man out of his mind.

The weather is not always the only problem he faces. Honesty is something he must have as part of his credo. It is a great temptation to call a shot on the optimistic side, perhaps because he knows that is what others want to hear, or because the pressure is on. It takes real guts to issue a gloomy forecast that might ground everything, while at the same time knowing that the fickle weather may make him look like a chump. But if he has what it takes to stand on his judgment and adjust to a changing situation, then he deserves the attention and respect of those depending on him — even when he's wrong.

Then there are the electronic guys with their tubes and transistors and scopes. Snow and rain foul them up and they lose their targets. At the same time they know that pilots are depending on them, sometimes critically. Their capability is based on the training and experience they have had, judgment, and an infinitely complicated maze of electronic gear. If one element fails them, then they may fail the pilot, perhaps with fatal results. Responsibility? They have a tremendous load of it sitting squarely on their shoulders.

This brings us to the people with, physically speaking, the nastiest job of all — the facilities people who clear the ice and snow, inspect and service the barriers, determine the RCR. Discomfort is a way of life, but they know they can't get the job done sitting in a warm building. Their work could have been made easier by good planning and execution of that planning back when the weather was a lot more comfortable. It is much easier to construct proper barrier well drainage in August than to have to get the ice out in January. Good training a few months ago would have prevented the accident that occurred when an inept driver drove his snowplow into the side of an aircraft. Conversely, the driver that knows his job will plow the taxiways wide enough so that an aircraft doesn't catch a wingtip in a snow bank.

Take a look at any airbase and what do you see? People? Machines? Buildings? Aircraft? Yes, all of these. What we must remember is that everything — people, buildings, machines, miles of pavement — are there for just one purpose: to support the pilot so that he may perform his mission. All of these things and the aircraft are, in final analysis, simply tools to be used by the aircrews to perform a vital job. This does not mean that any component is any less important than another. Take another look around. There are a lot of someones down here who help bring our aircraft home safely. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

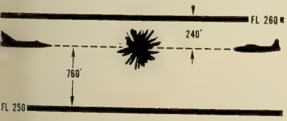
Q. I have recently been appointed Instrument Training Officer for our squadron. I am planning a briefing on altimeter installation error and have designed the following situation to emphasize the need for applying the correction factor on all flights.

- An F-102 indicating 350 knots (.82M) is eastbound on a certain Jet Route at an assigned altitude of FL 250. Altimeter installation error is minus 760 feet; therefore, the altimeter should indicate 24,240 to maintain FL 250.

- A T-33 indicating 275 knots is westbound toward the F-102 on the same Jet Route at an assigned altitude of FL 260. Altimeter installation error is plus 240 feet; there-ore, the altimeter should indicate 26,240 to maintain FL 260.

- If neither pilot corrected for he error, the aircraft would theo-etically meet head on at the same ltitude.

Would you help me explain why he T-33 and F-102 installation er-ors are in opposite directions, since oth aircraft have the same type ltimeter, the assigned altitudes are lose, and the indicated airspeeds liffer only 75 knots?



This question was selected for the "IPIS Approach" for everal reasons, one of which was help clarify some of the existing ight manual instructions for ap-lying altimeter corrections. For xample:

- F-102 — "Add correction to ob-ain true pressure altitude; subtract orrection to obtain indicated alti-ıde."

- F-105 — "Indicated altitude equals pressure altitude minus (plus or minus) correction."

- RB-47H — "Pressure altitude equals indicated altitude plus or minus correction."

- T-39 — "Indicated pressure altitude equals calibrated altitude plus correction."

- B-57D — "Calibrated altitude equals indicated altitude plus correction." (Enter chart with true altitude.)

- T-38/F-5 — "Indicated altitude equals pressure altitude plus correction." (Correction may be plus or minus.)

- C-118 — "Add correction to altimeter reading to obtain altitude."

- C-54 — "Altimeter reading plus correction equals true altitude." . . . Confusing, isn't it?

Altimeter installation error (often called position error) is caused by the flow of air over the static source and is a function of indicated airspeed, altitude, and in some cases configuration.

Aircraft equipped with a pitot-static boom (F-102), when flying at subsonic speeds, will generally have higher pressure than ambient existing at the static source. This high pressure results from pressure waves that form on the pitot-static boom. The faster the aircraft moves through the air mass, the more pronounced the pressure wave becomes, until eventually the pressures reaches its maximum value, usually just prior to Mach 1. At this time the pressure wave would be located at the static source and error may be as great as 3000 feet in some aircraft. As the aircraft speed increases to supersonic, the pressure wave moves aft of the static source resulting in decreased pressure and possibly zero error or error in the opposite direction. The high pressure existing at the static source will cause the altimeter to indicate lower than the actual altitude. In other words, with the assigned altitude indicated on the altimeter, the aircraft will be erroneously high. Therefore, in order to maintain an assigned altitude, the altimeter must be indicating lower than the assigned altitude by the amount of the correction factor.

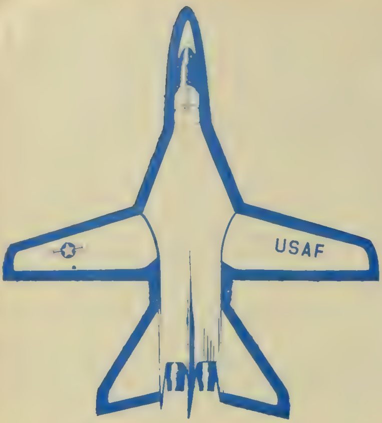
Aircraft equipped with the static source on the fuselage (T-33) have a different problem. With this installation the airflow across the static source usually creates a lower than ambient pressure because of the venturi effect. The low pressure existing at the static source will cause the altimeter to indicate higher than the actual altitude. In other words, with the assigned altitude indicated on the altimeter, the aircraft will be erroneously low. Therefore, in order to maintain an assigned altitude, the altimeter must be indicating higher than the assigned altitude by the amount of the correction factor.

Use the explanation here to help interpret your altimeter installation error charts. Apply the correction factor on *all* flights.

This issue marks the first anniversary of the "IPIS Approach." We greatly appreciate the tremendous response this feature has created. Continue to send us your questions and we will find the answers. Seasons greetings from your Instrument School.

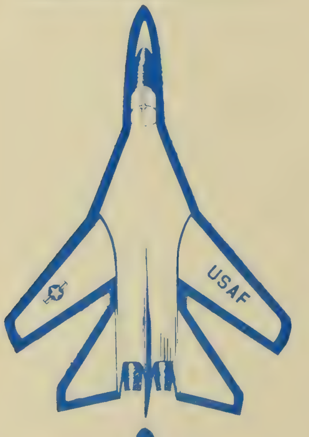
Robert D. Williams

Robert D. Williams
Col, USAF
Commander, Instrument Pilot Instructor School



High, low slow and safe

Grover C. Tate
General Dynamics/Fort Worth



With the development of the General Dynamics variable wing-sweep F-111, the humor in the old warning to stay low and slow is lost. The pilot can change the sweep of the wings during flight and can essentially redesign his aircraft for safe performance for operating high and fast, high and slow, low and fast, or low and slow. This selectivity allows the pilot to tailor his wing position to give him maximum safe performance for the conditions of any assigned mission. The wing-sweeping capability allows the pilot to tame his mach busting mission tiger into a docile pussycat for takeoff and landing.

The variable sweep wing is but one, although perhaps the most outstanding, safety feature of the F-111. As a result of the safety organization that was established within the Air Force and General Dynamics F-111 Project Offices, safety considerations were emphasized as an integral part of the total design and development effort. Safety was a part of the aircraft and not a tolerated tag-along consideration. As a result of this organizational structure, flight safety representatives participated in pre-engineering inspections, symposiums conducted by flight safety groups, design engineering inspections and sub-contractor design reviews. They made orientation tours of operational bases, and took cruises aboard Naval aircraft carriers to become familiar with carrier operations. Records of Air Force and Navy accidents were studied and lessons learned from this review were put to work in the F-111 design program. Maintenance problems were studied and designs were made to avoid conditions that would create, or be subject to the same or similar problems. Because of the emphasized safety program during the design phase, safety has been given its just consideration all of the way from the idea stage to the finished product.

Many significant safety features evolved from the early considerations and others are there by basic inherent design characteristics. The variable sweep wing is the primary safety feature and is most significant during the takeoff and landing phase where the greatest number of aircraft operational accidents occur. When the wing sweep is used in conjunction with the flaps and slats it allows:

- Low takeoff and landing speeds.
- Short takeoff and landing roll.
- Low angle of attack during takeoff and landing and resultant good pilot visibility during both phases.
- Ability to use almost any type of airstrip for takeoff and landing.

Large, low pressure tires provide the ability to operate from relatively soft surfaces, increased blowout resistance, and exceptional braking effectiveness.

Both main wheels are attached to a single axle, eliminating the one wheel up-one wheel down landing.

Wheel brakes are powered by a dual system. An accumulator backup is provided for each system, an auxiliary brake is available if normal and backup fail, and as a court of last resort — a tail hook is available. Landing roll spoiler brakes aid in the braking effort. Proportional, modulating anti-skid is utilized to prevent wheel skid. Thermal plugs relieve tire pressures in the event of overheat. If a tire should fail, the wheels are nonfrangible and compound damage will not follow.

Once airborne, what does the pilot have going for him? First, there are two engines, both with automatic restart ignition. With one engine operating, the other can be started by cross bleeding. Both the constant speed drive oil system and the basic engine oil system are self contained — no feed lines exposed to damage or failure.

Two completely separate hydraulic systems provide power for the flight controls, landing gear, brakes, and other hydraulic functions. Each system has a pump on each engine. The primary hydraulic system is reserved for the operation of the flight controls and wing sweep. The utility system shares in the operation of these systems but also provides power for all of the other hydraulic demands of the aircraft. If the primary hydraulic system fails, all of the other functions of the utility system are isolated from the system. The flight control and wing sweep systems then have the exclusive services of the utilitv system. Backup accumulators and air bottles are available for the operation of other hydraulic functions in the event of utility system isolation. The flaps, normally hydraulically actuated, have an electrically actuated emergency system. To preclude hydraulic system failure, all of the hydraulic system pressure lines are made of steel.

Electrical power is generated by two independent systems for both AC and DC power. An AC generator on each engine powers a bus for its system and is capable of supplying all of the electrical demands of the aircraft plus a 30 per cent overload. If either generator fails, or is inoperative because of an engine shut down, the two busses are automatically connected and the remaining generator operates both systems. When a generator overheats, a thermal sensing device will cause the generator to be decoupled from the engine to prevent additional damage.

If the generator malfunctions, the pilot can decouple it from the engine by the press of a button. Transformer-rectifier units are arranged so that any time AC power is available, DC power will be provided. An emergency generator, driven by the utility hydraulic system, is activated if both main AC systems should fail and provides both AC and DC power within three seconds of the time of failure.

The flight control system is a dual control, triple redundant system. Separate channels of mechanical linkage control hydraulic servo actuators which move control surfaces. Stability augmentation is provided for roll, pitch and yaw by use of triple redundant electronic circuitry and electro-hydraulic dampers.

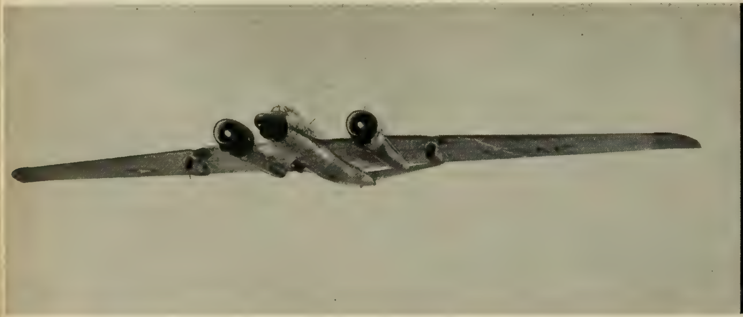
Symmetrical wing sweep movement is assured by two hydraulically powered motors driving threaded, mechanically synchronized actuators. Failure of either hydraulic system will not prevent changing the sweep position of the wing, but will only slow the rate of change.

Perhaps the most revolutionary safety feature of the F-111, in addition to the wing sweep, is the crew escape module. The first aircraft have conventional ejection seats. Present scheduling calls for installation of the escape module beginning with Nr 12 aircraft. The module feature gives the crew the capability to successfully escape from the aircraft at any point within the operational envelope — from static against the blocks through 2.5 mach at altitude. Redundant systems are provided for module separation initiation; reliable mild detonating cord and linear shaped charges are used in the severance system. After the module is separated, it provides the crew with the tools of survival for any environment — land or sea, hot or cold. The module is a close cousin to the escape vehicles used by the astronauts and provides the non-orbital pilot with the same escape and survival potential as his spaceman contemporaries.

Many years ago when the B-26 Marauder was the hottest bomber in the business, a pilot had successfully negotiated a complete mission only to have the copilot, with full cooperation of a malfunctioning gear safety switch, retract the landing gear at the end of the landing roll. The hero of this brown shoe epic then punched the copilot squarely in the nose and reported to the Ops Officer, "I took care of the copilot, you all take care of the aircraft." Now, in the case of the F-111, the designers and engineers have taken care of the aircraft, and of the pilot. ★

WEATHER SCOUT

Maj Henry K. Good
Chief, Safety Division,
9 Weather Recon Wg
McClellan AFB, Calif.



Ice fog, hurricane, foehn wind, typhoon, tropical thunderstorm, CAT – these are some of the weather phenomena that daily confront the aircrews of the 9th Weather Reconnaissance Wing, McClellan AFB. Commanded by Colonel Carl H. Morales, this Air Weather Service Wing has six squadrons, two detachments and three task flights. The aircraft? Five different types – WB-47E, RB-57B and C, RB-57F, WC-130B and E and WC-135B. The mission: To provide weather reconnaissance and atmospheric sampling as directed by the USAF and DOD.

To get a better picture of the operation let's look at the units and their locations.

The 53 Weather Reconnaissance Squadron (WB-47E's) is located at Hunter AFB, Ga., with a detachment flying WC-130B's at Ramey AFB, Puerto Rico. The area of responsibility is the Atlantic, Gulf of Mexico, Caribbean, Mediterranean and the Middle East. Known as "The Hurricane Hunters," the 53-WRS crews specialize in hurricane hunting, air refueling area support for TAC rotational moves, NATO exercises, weather reconnaissance for the Air Force Eastern Missile Test Range and similar missions.

The 54 WRS "Typhoon Chasers" is located at Andersen AFB, Guam. Their area of responsibility – the central and south Pacific and the Philippine Sea. Typhoons, weather reconnaissance for TAC fighter movements, atmospheric sampling and synoptic weather tracks are but a few of their assigned jobs.

At McClellan AFB is the 55 WRS (WB-47's and WC-135's) with a detachment at Eielson AFB, Alaska. These crews fly standard daily routes (or tracks) between the West Coast and Hawaii, in the Gulf of Alaska, and over the Arctic Ice Cap to 86 degrees N latitude. Special missions are also flown at the request of various agencies. These special mission requirements many times demand global weather reconnaissance and long TDY's. In addition, the 55th crews and aircraft have traditionally helped the other squadrons during periods of heavy commitments.

The 56 WRS (WB-47's and WC-135's) Yokota AB, Japan, provides atmospheric sampling, refueling area reconnaissance, etc., in the Northwest Pacific, Philippine Sea, Sea of Japan and the East and South China Sea.

The 57 WRS (WB-47's), Hickam AFB, Hawaii, has just moved from Avalon Airfield, Australia. At the same time it is changing from RB-57B and C's to WB-47's. The mission is support of the satellite programs, missile recovery projects, TAC rotational moves and numerous special missions.

The 58 WRS (RB-57B and C's and RB-57F's), Kirtland AFB, New Mexico, has three Task Flights, Alpha, Bravo and Charlie, located at Eielson AFB, Alaska, Albrook AFB, Canal Zone, and East Sale RAAF Station, Australia. The 58th is the only designated USAF unit whose primary mission is nuclear test and atmospheric/stratospheric sampling. The primary aircraft used is the RB-57F, an "exotic" of the first order. Powered by two TB-33-P11 turbo fans *and* two J-60-90 turbo jets, its angle-of-climb and high altitude performance are sensational. It is designed for flight above FL 600 and the crews must wear full pressure suits. As a result SMSgt John R. Penz, NCOIC of the Personal/Survival Equipment Section, is known as the wardrobe master of the most expensive clothes closet in the West. The four-layer suits are almost identical to those worn by the astronauts and cost the USAF $7800.00 apiece.

Needless to say, the varied missions and aircraft of the Wing present a number of challenges to mission effectiveness and safe operation. What are these challenges? How are they met?

Mobility requirements: The varied missions call for the use of civil airfields that have never before been used by RB-57F, B/WB-47 and C/WC-135 aircraft. With no normal base support, the crews are on their own. Refueling, Dash-6's, etc., all become crew duties. For use in warm climates the WB-47 must have water/alcohol available for takeoff, the runway approaches must be clear and the taxiways must be wide enough to support the out rigger gear (44 feet 4 inches apart). The RB-57F doesn't need long runways or water alcohol injection, instead it needs very smooth, wide taxiways and runways. Its flexible 122-foot wing has a tip clearance of 22 inches static. A rough taxiway combined with high taxi lights spells damage. Both the RB-57 and WB-47 have critical crosswind factor followe closely by the WC-135. The answer? Airfield surveys are made o all questionable airfields prior t committing 9WRW aircraft to using them.

Historically, the weather recon squadrons have had very lean manning. The only UMD officer slots are Commander, Operations and Materiel, the rest are all crew slots. All crewmembers have additional duties such as Chief of Personnel and Administration, Safety, Assistant Operations Officer. This requires close coordination and command supervision since it is not unusual for half of the crew members to be on extended TDY and most of the rest flying local commitments. So — who's watching the store? Those who are left must be able to fill in and do the job correctly.

Hurricane and Typhoon penetrations: Due to structural limitations, the WB-47 cannot penetrate under any circumstance. When possible they overfly the storms; if not, they relay METRO information and take oblique radar photos. They do an excellent job, but now with a full complement of WC-130's an old system is returning. The WC-130's penetrate hurricanes and typhoons as the WB-50's did in the past. On Hurricane Betsy a new dimension was added to storm tracking and analysis. The RB-57F was used to overfly Betsy and take vertical photos, meanwhile the WC-130 penetrated, giving a horizontal cross section of the storm.

We feel that reconnaissance on this particularly vicious storm was typical of our capability. Excellent positions were maintained throughout the storm's life. When the storm established a new course toward Southern Florida, detection of the change enabled new forecasts to provide timely warning for the Florida Coast. The same was true for the storm's arrival along the Gulf Coast.

A "typical" WC-130 storm penetration is made in the following manner. First, the storm is surveyed by radar to obtain an overall view. Wall cloud thickness and intensity, eye size and shape and precipitation areas are the predominant features observed. If the wall cloud is thin or broken in one quadrant of the storm, the penetration track will usually go through this area. If the wall cloud is continuous, other factors such as precipitation returns, distance to the eye, etc., are considered in selecting a track to the eye. The idea is to get into the eye with a minimum exposure to turbulence. Once inside the eye, where the weather is very calm, much additional data is gathered. A radio-sonde instrument is ejected from the aircraft and floats to the surface at pre-determined rate of descent. Temperature, humidity and atmospheric pressure are continuously sent back to the aircraft until the instrument contacts the surface. Meanwhile the weather observer is also taking readings of temperature, humidity and atmospheric pressure. All of these data are charted to give an exact inside picture of the storm. The navigator plots the exact location of the eye and then the bumpy ride to the outside begins. Depending upon fuel remaining and distance to home base, the crew may loiter for three to six hours, make another penetration and then go home.

The special high altitude application of the RB-57F adds a whole family of challenges. The fatigue induced by six plus hours in a full pressure suit is immeasurable, thus crew rest time can be extended at the discretion of the attending flight surgeon. This, of course, extends the turnaround time.

During the 72-hour period prior to a pressure suit flight the crewmembers must go on a special diet of low residue, low-gas forming foods. The old rule of 12 hours from bottle to throttle is out; alcohol should not be taken for a minimum of 24 hours prior to flight.

Preflighting an aircraft while wearing a pressure suit is out of the question so another crew must do this job.

Once the pressure suits are donned they must be ventilated. Shock from dehydration and heat can occur in a matter of minutes in hot climates. A special air-conditioned van is used to transport the crews from P.E. locker room to the aircraft. That's right, before RB-57F's can operate from a base, one of these vans must be in place accompanied by a contingent of specially trained physiological support personnel. The 9WRW answer to these special physiological challenges is the assignment of three specially trained flight surgeons. They are all pressure suit qualified and maintain close contact with the crews at all times.

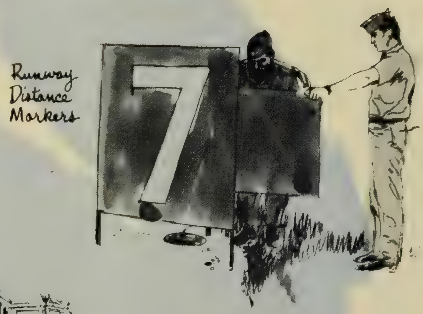
There you have it. If your job calls for driving a fighter to Europe or Asia with a "few" refuelings enroute, it should ease your mind to know that the entire track has been scouted not once but twice by crews that have spent a good bit of time on the receiving end of an airborne gas station themselves. If your question has to do with the current amount of radiological debris in the atmosphere or stratosphere, the 9WRW crews have an answer for you. Last but far from least, if you want to know the location and direction of movement of a hurricane, typhoon or tropical depression, the 9WRW crews will fly day and night to get you an answer. ★

Two of AWS' newest aircraft, the RB-57F of the 58 WRS, Kirtland AFB, N.Mex., and a new WC-130E belonging to the 54 WRS. The WC-130 has been specially modified for weather reconnaissance work to include penetration of tropical depressions, storms and typhoons. The RB-57 is a high-altitude aircraft designed for atmospheric sampling operations.

Arresting Barrier

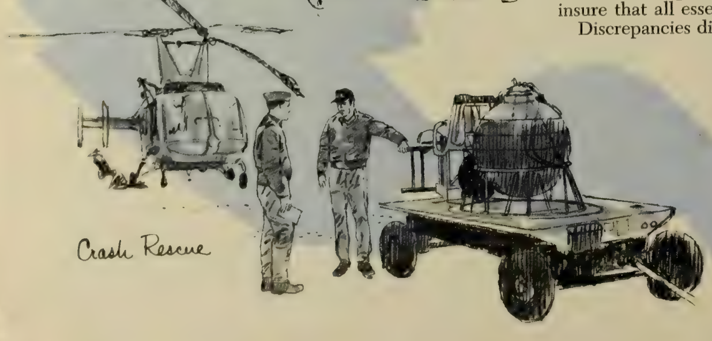
Monitor Safety Survey

Maj Jack R. Pulliam
Directorate of Aerospace Safety


Runway Distance Markers

Crash Rescue

Extinguisher Inspection


Crash Rescue

Ground Safety Program

Time was when a major function of the Director of Aerospace Safety was conducting safety veys. This has been replaced by the Mon Safety Survey Program, whereby we look over shoulder of the major air command during the co of the command survey. Our purpose is to evalu the effectiveness of the command system by part pating and observing the command team while t are conducting a safety survey.

The scope of the monitor survey encompasses fli missile, nuclear, ground, and explosive safety aspe as dictated by command mission requirements. veys include review, observation, and evaluation the following:

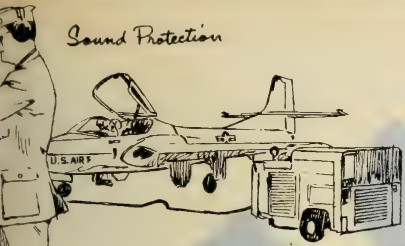
- Survey pre-planning and preparation.
- Team Organization, composition, and qualif tion.
- Briefs and critique techniques.
- Survey execution and findings.
- Special items of command interest.

To accomplish the objective of evaluating comm safety survey capabilities, the following approac being used: An evaluation checklist has been veloped. This checklist is flexible and may be amen to fit each situation and organization.

A pre-survey briefing is conducted to inform command of the role of the USAF team and de areas of participation and observance.

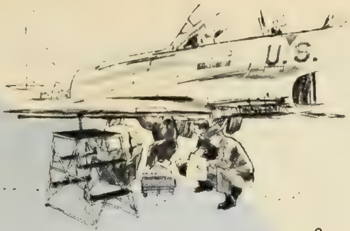
USAF team members are assigned to specific a and command team members to observe the latt effectiveness, preparation and qualifications, and insure that all essential areas of inquiry are survey

Discrepancies discovered by the USAF team, ex

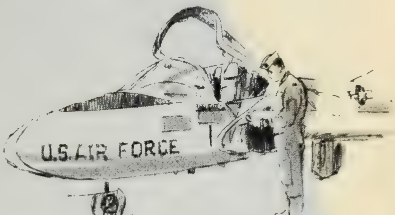


Sound Protection

Aero Club

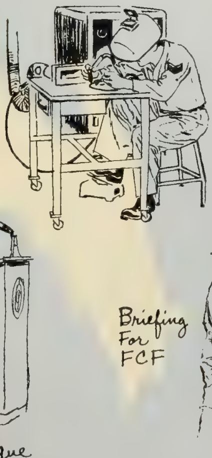


Unscheduled Maintenance Inspection

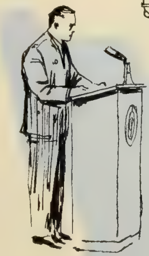


Spot Inspections

Egress and Explosives



Heli-Arc Welding Shop



ATC Critique

Briefing For FCF

or those considered as being critical, are reported nly to the command survey team.

USAF team members attend command progress ieetings, as well as the entrance and exit briefings, to bserve briefing techniques, team control, and “on-te” planning techniques.

An exit briefing is given to the command safety surey team upon completion of the unit survey.

After returning to the Directorate of Aerospace afety, team members prepare a memorandum report hich is submitted to the command, indicating an valuation of the command team efforts, adequacy of ne command final report, and concurrence or non-ncurrence with findings. A passing or failing grade, for that matter, any kind of score, is not a part the survey report. Areas are indicated as being adeuate or inadequate.

Particulars of one energetic, comprehensive safety rvey we monitored are covered in the accompanyg illustrations. Although the unit surveyed enjoys a w accident rate, the survey team observed several fety areas requiring corrective action. These were sclosed to the unit commander to assist him in his fety program.

The monitor safety survey program is a more efient and economical method of determining the efctiveness of command and unit accident prevention ograms, showing commanders where hazards can lessened or eliminated. Since great variance in sury effectiveness has been noted between commands, behooves every commander to insure that an efctual, energetic, comprehensive safety survey pram exists throughout his command. ★

Training Mission

Tower and RSU

RSU Remote Flare Guns

HOW WE TAMED THE TIGER IN OUR TRANSMITTER

Jack B. Scott, Director of Ground Safety
AFCS, Scott Air Force Base, Illinois

During a period prior to 1959, the Air Force Communications Service, then the Airways and Air Communications Service, was electrocuting a man a month in the maintenance and operation of electronic equipment. This rate has been gradually reduced to zero. There have been no fatalities from electrical shock in the past two years. This, in spite of the fact that the Communications Service now has twice the number of people it had prior to 1959 and is operating much more sophisticated equipment at higher voltages.

The elimination of electrocutions was not a matter of luck. It was brought about by systematic analysis of the hazards involved in the maintenance and operation of electronic gear and a program designed specifically to eliminate or guard these hazards, or to circumvent them by development of detailed safe operating procedures.

What is so special about ground safety hazards in communications facilities? Aren't these much the same as those likely to be found in any other base activity? Consider a typical safety survey recently conducted of one of our communications squadrons by well qualified base safety personnel. The survey report contained two discrepancies: (1) oily rags were found in an air conditioning room and (2) a fire escape rope was old and worn. In contrast, an AFCS safety survey of the same squadron listed 65 discrepancies. Why the difference? "Why the difference" is one of the reasons for this article. I hope to give you some idea of AFCS facilities and functions, the safety hazards peculiar to our operations, some idea of what we expect in the way of accident prevention measures by our units, and an indication of the educational and training requirements we have that are peculiar to the Communications Command.

The TACAN transmitter component shown in Figure 1 illustrates some of the typical hazards that we encounter on a day-to-day basis. If the equipment handled by this man were in a hot condition, this would be a typical "How Not To Do It" picture. The component he is working with has many points of exposure of 300 volts or over. Much of this equipment must be

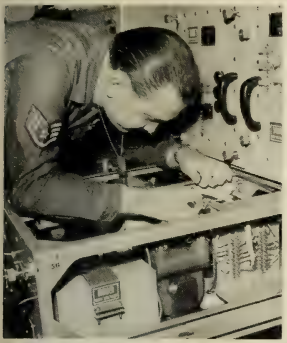


Fig 1, left, some typical hazards encountered daily. If equipment being handled were in a hot condition, this would be an ideal "How Not To" illustration, particularly for airman wearing metal pencil and security badge.

Fig 2, right, another NAVAID — a VOR transmitter. The safety observer is a standard requirement rigidly enforced in AFCS. Work on high voltage equipment is not permitted unless he is present.

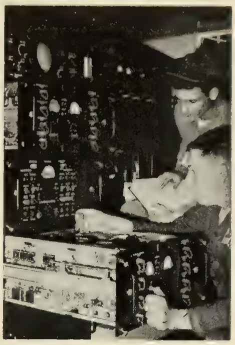
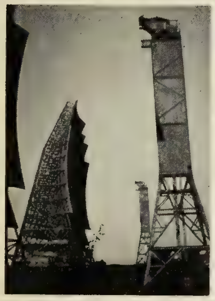


Fig 3, right, the Mark 85 tropospheric scatter antenna reaches 118 feet into the air and requires maintenance in all kinds of weather.



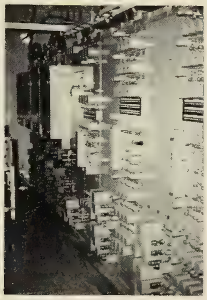


Fig 4, left, tropo site with transmission equipment. Tubes and checkpoints are accessible from exterior, eliminating working "in the blind."

adjusted while hot, must be handled in confined quarters, and often has to be repaired in the minimum of time, such as would be the case with this TACAN component. Note this maintenance man is wearing a metal pencil and a metal security badge—this is not done when maintaining live equipment.

Figure 2 shows another NAVID — a VOR transmitter. Note the safety observer. This is a standard requirement that is rigidly enforced in AFCS. We do not permit any work to be done on high voltage equipment unless a trained safety observer is present.

Figure 3 shows our Mark 85 tropospheric scatter antenna and illustrates several of the other problems that we face. Personnel must climb up into the feed horn. This is usually done with the equipment de-activated. However, some adjustments are made while the equipment is hot. If a man gets between the reflector and the antenna, he can receive quick, serious and, perhaps, fatal RF burns.

Tropospheric scatter is a system of communications which depends upon propagation of a high intensity power output reflected from the tropospheric layer back down to a receiver site. High power outputs are required in order for the next receiver site to receive a minute amount of energy, which is then amplified and, if required, retransmitted to the next station. The advantages of this system are less interference by atmospheric conditions, difficulty of jamming, and lack of interference by terrain factors. From a safety standpoint, however, the high power output of up to 100 kilowatts (constant power output) presents many problems. The antenna reaches 118 feet into the air and often requires maintenance in all kinds of weather.

Although not shown here, the microwave transmitter antenna is often co-located on the tropospheric antenna. The microwave antenna requires frequent maintenance and adjustment. Safe exposure level for RF radiation is established at 0.01 watt/cm^2, and precautions should be taken to avoid exposure of personnel to ambient power levels in excess of this amount for any prolonged periods of time.

Figure 4 shows some of the transmission equipment employed in a tropo site. Note the safety factors in connection with this equipment. Tubes and checkpoints are accessible from the exterior. A minimum of exposure to high voltages is required. Equipment is well lighted so that maintenance can be done without use of flashlights. Working "in the blind" is eliminated.

There are 10,000 volts on the klystron tube in the microwave power amplifier (Figure 5). Note that all high voltage points are behind plexiglass or are metered on the surface of the equipment and cabinets are interlocked. All electronic devices or tubes capable of producing external X-radiation in excess of 300 MR per week must be protected by radiation-proof enclosures or the tubes must be properly shielded. Wherever any radiation hazard is expected, either RF or X-ray, a site survey may be requested from the nearest GEEIA Region. (Reference T.O. 31Z-10-4).

Figure 6 shows a typical 350 kilowatt diesel generator. Note the color coding of various supply lines, i.e., water, fuel, etc. Also, note electrically rated rubber matting in the front of the generator. A little known hazard in connection with diesel engines is that, with either no load or when a governor failure occurs, a diesel generator will seek the infinite speed. It will try to increase its speed until it blows up. If this runaway occurs, the only way to stop the engine is by shutting off the fuel supply. Our large generating plants also have a noise problem, and ear defenders are required. Personnel working in these locations must have periodic audiometric examinations.

One of the common hazards in AFCS facilities, namely, the closeness of the equipment, is shown in Figure 7. This is particularly true of mobile gear. It is virtually impossible to work on one piece of equipment without having part of your body against the cabinet of an adjacent piece, thus affording a sure continuity of ground through the person doing the work. The only real solution to this problem is extremely good grounding and bonding of all equipment and components. Incidentally, grounding sticks are required to be permanently installed on all equipment cabinets on which high voltages are employed.

Figure 8 shows a typical CPN/4 mobile GCA. Personnel working on the equipment in this unit are exposed to as much as 27,000 volts in the magnetron circuitry. A magnetron is a high vacuum tube containing a cathode and an anode. The latter usually is divided into two or more segments in which a constant magnetic field modifies the shape charge distribution and the voltage current relations. In modern usage, the term magnetron usually refers to magnetron oscillators in which there is an interaction of the electronic space charge with the resonant system which converts direct current power into alternating current power, usually at microwave frequencies. RF at the antenna may be in the order of 750 kilowatts (pulsed power). Most mobile NAVAID equipment employs battery banks of wet cells operating at 28 volts, but up to 300 amperes of current. At least one electrocution and numerous other accidents have occurred as a result of a high intensity DC arc, such as from a screw driver, causing the person to jerk involuntarily and contact a high voltage point in the equipment.

Battery compartments in mobile vans have blown up on several occasions from accumulated hydrogen gas. An installed blower motor partially eliminates this problem. Antenna rotation has also caused a number of accidents. One contract technician was knocked off the roof of a piece of equipment when an airman inadvertently turned on the switch. Cathode-ray tubes employing up to 10,000 volts will be found in these units. One of the primary hazards in connection with GCA, RAPCON, and the new AN/FPN-47 is the fact that personnel must operate, adjust and maintain the equipment in the dark. Darkness is required in order to operate the scopes. Standby equipment is located in the same van, and the facility usually cannot be shut down during maintenance activities.

These are only a few of the more typical facilities found at almost every AFCS squadron. In addition, of course, we have a number of large communications centers and long haul transmitter sites employing monstrous communications equipment. I use the word "monstrous" literally. We have had airmen fresh out of communications school who took their first look at the FRT/4 and actually started shaking at the thought of working

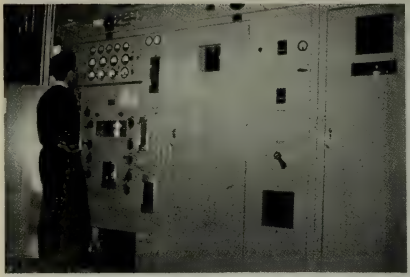
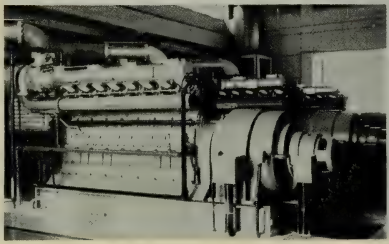


Fig 5, above. Note all high voltage points are behind plexiglass or are metered on the surface of the equipment and cabinets are interlocked.

Fig 6, below. A typical 360 kw diesel generator with color coding of water and fuel lines, with rubber matting in front of generator.



on this monster. It is no wonder that Safety or Inspection personnel are extremely wary about conducting surveys in a communications facility. The unfamiliarity with equipment and the fact that extremely high voltages are present are certain to have a diluent effect on a prudent safety man's incentive to visit these areas.

Another problem in connection with transmission equipment is the proximity to electro-explosives devices. Electro-explosives devices (EED's), such as squibs, blasting caps, primers, dimple motors, initiators, igniters, etc., are susceptible to being inadvertently ignited by exposure to the radiated RF fields of communications, navigation, radar, etc., type transmitters. The response of an EED to an RF field depends on such factors as the power output and frequency of the transmitters, the antenna propagation (directional) characteristics and polarization, the distance between the antenna and the EED's and their firing circuitry, type and configuration of the firing circuitry, etc. Careful consideration to these factors must be given in the locating of AFCS facilities (see para. 0623 and Chart 6-1, AFM 127-100).

To sum up the safety problems peculiar to AFCS:

- We must ground or bond all equipment.
- Protect people from inadvertent contact with high voltage by guarding or re-designing the equipment.
- Protect personnel from exposure to X-radiation and RF energies.
- Establish procedures whereby testing and tuning of equipment can be done with minimum risk.
- Minimize the hazards of antenna maintenance operations.

The above problems have been largely overcome by newer functional design of equipment, including several new techniques, such as servo tuning, probe holes for testing, key interlocks, antennae grouping, and others.

Each AFCS facility is now equipped with a Standard Safety Board. These boards are an innovation of AFCS and contain emergency rescue items, such as rope, hook with hardwood handle, resuscitube, flashlight, first aid kit, fuse puller, spare shorting stick, etc. The board is painted red with a white border and is clearly visible and readily accessible.

Training has also played a part in the success of safety in communications operations. All AFCS personnel who work with high voltage electricity are thoroughly trained in closed chest heart massage and mouth-to-mouth resuscitation procedures. Several lives have already been saved as a result of this training. (Reference film, "Pulse of Life," SFI 1322.) Frequent exercising of emergency equipment to communications facilities has been a special interest item for the past three years. In addition, extensive training is given the the rescue of personnel in contact with high voltage. This training emphasizes the use of the emergency equipment found on the Standard Safety Board described above. A film was developed for this specific training. (Reference FTA 554, "Emergency Procedures for Communications Facilities.")

It should also be mentioned that protective equipment has played a part in the elimination of electrocutions. The floor adjacent to high voltage equipment is covered by electrically rated matting. Each equipment rack has a shorting stick that is readily accessible, and personnel are required to ground each component at the exact point where work is being conducted. Electrically rated shoes are also a standard item for all personnel who work with high voltages.

It is one thing to prescribe a program and another to put one into operation. To insure that the AFCS Safety Program is functional, we stress periodic safety surveys of every organization in the command. To standardize these surveys, a comprehensive, specific survey guide (checklist) has been developed. This guide is self-rating and provides a good picture of the safety program of the AFCS facility that is being surveyed.

I hope this article has provided an insight into some of the problems encountered in the maintenance and operations of communications and NAVAID equipment and that it has also given some idea of how we are trying to solve these problems. If our 1958 on-duty fatality rate had continued through 1964, an additional 64 lives would have been sacrificed to the "tiger in our transmitter." We believe the results of the program speak for themselves. ★

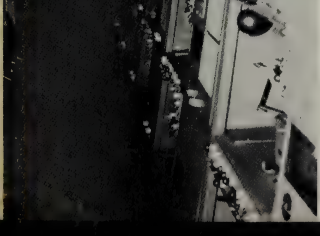


Fig 7, left, the closeness of equipment is a common hazard in AFCS facilities, since it is virtually impossible to work on one piece of equipment without some part of your body being against the adjacent cabinet. One solution is good grounding and bonding of all equipment and components.

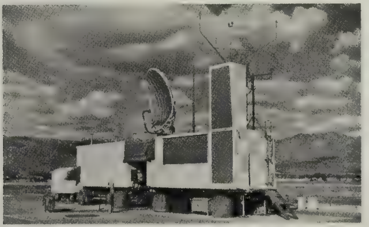


Fig 8, above, a typical CPN/4 mobile GCA. Personnel maintaining this equipment are exposed to as much as 27,000 volts in magnetron circuitry. Accidents have occurred as result of persons contacting high voltage point in equipment.

Missilanea

SHOELACED FALCON. It happened during a mass loading exercise. With a handling bar, two young, energetic load-crew troops picked up their trusty Falcon (AIM-4A type) from its storage container, headed for a handling frame and ultimately to the F-102 for loading. The first one or two steps were okay, but then came that *third* step alongside the empty storage container as they were moving out and over the handling frame. That's when one man's shoelace caught on one of the latches of the empty storage case. No, you're wrong! Latches had been laid flat against the storage case before loading started. Still, the shoelace caught it sufficiently to cause one man to stumble just enough to drop the fragile bird. He recovered his balance, but not before Nr 2 stabilizer on the bottom of the bird came in contact with the edge of the storage container. Result: Nicked (3/16 inch deep) stabilizer leading edge just forward of triggering area decal. A substitute Falcon was used to complete the load.

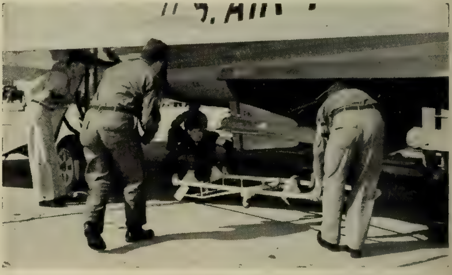
The ruffled bird was lucky — only one man-hour estimated to repair it. Had the entire missile dropped to the ramp, it might have been a completely "demoralized" Falcon, requiring motor disposal and depot repair — all because of a shoelace.

The report stated that this crew is currently wearing their shoelace ends inside their shoes when loading missiles. Another recommended solution to get rid of *excess* shoelace length and ends is to wrap them around and tie them at the back of the shoe. In any case, looks like an area that could be monitored by unit MSO's and crew chiefs.

FALCON IN A GARBAGE CAN! The tired F-106 was recovered back at the home pad after completion of alert at a forward strip. Because of a fuel leak at the refueling valve, the recovery crew chief placed a nice red and yellow garbage can under the single point refueling receptacle area to catch the leaking fuel. The bird was scheduled for missile downloading to facilitate repair of the fuel leak. Now, it being toward the end of a long day and time for maintenance crew change, the maintenance crew chief returned to the office. Downloading of the missiles was accomplished prior to the night maintenance crew's return to repair the fuel leak.

Downloading. Now here, somehow, is where the Falcon got together with the red and yellow garbage can. After missiles had been extended, and as the nose cone cover was being installed prior to downloading from the launcher rails, this badly bent Falcon was discovered. Damage consisted of:

- Forward section of fuselage buckled on launcher hook side of the missile approximately 20 inches aft of guidance unit.



- Guidance unit was dented two and one-half inches long, one inch wide, and three-sixteenths inches deep.
- Sealing sleeve had launcher rail indentation on launcher hook side.
- Forward stabilizers Nr 1 and 4 were separated from sealing sleeve.
- Apparent separation between forward fuselage and forward launcher hook ring.
- Stabilizer latch hook on left side of missile broken off.

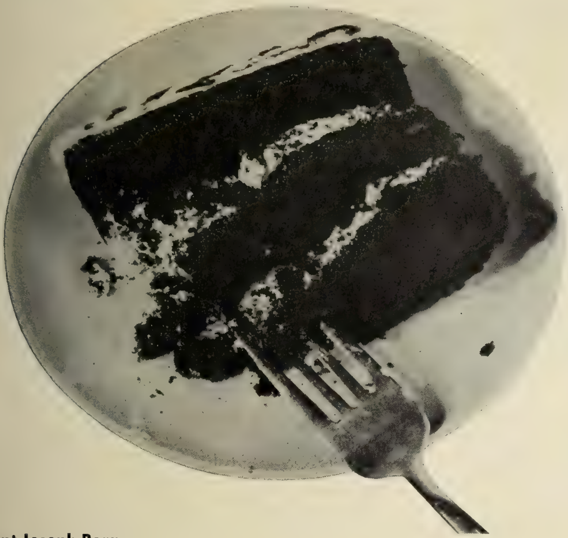
In other words, a badly ruffled Falcon, not reparable at base level.

"Who done it?" No one seemed to know — just "There it is!" But it was rather apparent by the red and yellow paint on the missile that the garbage can was involved.

Again, mishaps don't just happen — someone usually causes them. Cause? You guessed it! Someone did not follow the printed word and clear obstructions from beneath the doors. This Falcon, when extended on the launcher rail, came down on the top edge of the garbage can. Result: Best part of a $15,778 Falcon ended up in a garbage can.

Lt Col L. S. Tyler
Directorate of Aerospace Safety

A piece of cake...



Capt Joseph Bera
166 Air Transport Group
Wilmington, Del

When the alarm went off, I leaped out of bed, stumbled across the room and pushed the button down. The luminous hands said two-thirty in the morning. While dressing, I ventured a look outside and the sky looked like the lights of a large city. A typical cool, crisp January in southern Florida.

My wife had roused herself sufficiently to mumble something about breakfast before leaving for work. I declined, I could pick something up on the way. Work today was a thousand miles away in Memphis, Tennessee. As a part-time pilot in the Tennessee Air National Guard, I was scheduled for a trip to Madrid, Spain, in three days. I had to check in with my unit today.

The sleepy bundle on the bed was given a hug and kiss, and her parting words were "drive carefully."

"No sweat," I replied, "this is a piece of cake to a fearless aviator."

On the way out of town I stopped and had breakfast and several cups of coffee to wake me up, then picked up Highway 41 West through the Everglades. The engine in the car was purring smoothly, the radio playing soft music and the night was abnormally quiet except for an occasional passing truck and semi-trailer. Some 100 miles later, Route 41 intersected Highway 27. This would take me north through the citrus belt. Idly I heard one of the news broadcasters mention that, because of the frost danger, the citrus growers were burning old tires, common practice to ward off frost. He said also that smoke and fog would be a problem in the low areas that day. It didn't sound very significant at the time.

By 0700, having come about 200 miles, I stopped for gas at a station eight miles south of Haines City. After telling the attendant to fill it up, I engaged in the usual small talk about the weather. The attendant mentioned that there was a heavy concentration of fog about three miles down the road. He said there were several wrecks. I was sorry to hear that, I told him, but I had to go and with a full tank I drove off.

Sure enough, in about three miles the road disappeared into a solid fog bank. Approaching it, I turned on the headlights, slowed to 40 mph and punched right in. After all, wasn't I the fearless pilot with an instrument card? After about 200 yards the hair stood up on my neck and I had a peculiar sensation that all was not right. I immediately slowed down. At 30 mph I shifted into third gear. Suddenly, directly in front of me, a vehicle's tail lights! Instinctively I swerved to the left. Wham! It was too late. I rammed into the rear end. I was thrown into the windshield and continued upward to bounce off the frame of the window. The pain wasn't great, but I was conscious of a numb sensation and I could not see due to blood in my eyes. Something jarred my stunned brain — get out of the car before someone hits me from behind. After stumbling out of the car and walking in the direction which might take me to the side of the road I felt soft grass under my feet and knew, for the present, at least, I was safe.

Now I began to be concerned about my injuries. My thoughts were distracted by the sound of an approaching vehicle, then the screech of brakes and crash of metal. So now there were three.

Shortly after that I heard voices down the road. I called out for assistance. A man came over and started to lead me away. He made no effort to evaluate my injuries. The one thing that did flash before my bloody eyes was the mental vision that my flying career seemed to be over.

Because of the enormity of the accident it was only minutes before the highway patrol and an ambulance arrived. I was whisked away to the hospital. The doctor ordered x-rays and then started in on the gory mess.

The result of all this was no trip to Spain, $800 damage to the vehicle, severed ear, lacerations about the face and head, broken nose, scarred eyeball, torn leg ligaments and twenty-two days in bed.

This was a piece of cake?? ★

THE MOST DANGEROUS FLAME

Willie Hammer
Directorate of Aerospace Safety

Do you like to live dangerously? Would you like to have tremendous destructive powers under your control? Would you like to have a job which gives you a wide assortment of ways in which you can kill yourself? Be a welder. Especially a careless welder!

As a welder you can get yourself electrocuted, blasted in an explosion, burned to various degrees, asphyxiated, or afflicted in other ways. This country's costliest fires of the past 50 years were caused by welders. Among these were:

- Loss of the ocean liner, S.S. Normandie, which eventually capsized at a cost of 53 million dollars.
- The destruction of the General Motors Livonia Plant, at a cost of 6 lives and 45 million dollars.
- Damage to the newly launched, but uncompleted aircraft carrier, U.S.S. Constellation, with a loss of 50 lives and more than 40 million dollars.

All three of these accidents had two factors in common. Each was caused by a welder carrying out duties he had probably performed thousands of times previously without incident. Then, each welder, on a different day in his own different way, was careless. Catastrophies resulted.

Fires have been caused at Air Force installations by welding performed carelessly by both Air Force and contractor personnel. Those concerned with welding operations must be aware of the hazards and precautionary measures involved.

One of the factors which contributes to carelessness is the harmelss appearance of the flame or arc. The welding or cutting flame is only two to three inches long when acetylene or hydrogen gas is used. Although the flame is hot, it radiates little heat. When electrical equipment is used, there is no flame or heat until welding actually starts. Then, the arc is only one-quarter to one-half inch in length.

The sizes of these flames and arcs are misleading indicators of their potential hazards. An oxyacetylene flame may have a temperature as high as 5600°F; some types of welds run even hotter, as high as 11,000°F in the atomic hydrogen method. At these temperatures, materials which are generally regarded as nonflammable, will ignite, and in some cases, explode. Residues of materials which are only moderately flammable may burst into flame even when they are not immediately under the flame or arc. Although they may be some distance away, the heat conducted through the metal being welded may cause them to vaporize and raise their temperatures above the autoignition point. During a Titan I update program, insulation close to the area where a pipeline weld was being made was not removed. The heat caused charring and burning of the normally stable insulation.

Because of its high conductivity, metal remote from a surface being welded, but part of the object, may be dangerous to the welder. This metal may not be hot enough to glow, but still hot enough to burn the skin badly.

Hot spatter, dripping weld metal (slag), and sparks may cause burns, fires, and other damage at consider-

able distances from the welding operation. A fire in a Titan I silo started when sparks generated during electric welding ignited hydrocarbons in a sump. After update of an Atlas F silo, a small burned hole was found in the pressure balance joint (PBJ-2) in the liquid oxygen system. The hole was probably caused by slag drip from heliarc welding at a higher level.

Another hazard is created when acetylene or hydrogen from gas welding or cutting equipment leaks into an enclosed space. This may result in a flammable or explosive atmosphere needing only a spark or initiation of a welding flame to cause an uncontrolled fire. Leakage of oxygen from gas cylinders may make the atmosphere oxidizer rich, contributing to easy ignition of grease, oil, solvents, or other flammable materials.

Welding in enclosed spaces is also more hazardous than open air welding, since gases and fumes which are generated may not be dissipated. Some of the deleterious materials may be: (a) acetylene, carbon dioxide, and other inert gases; (b) fumes of zinc, lead, cadmium, or other metals; (c) decomposition products such as phosgene from halogenated hydrocarbons such as trichloroethylene, or fluorides from electrode coatings; (c) exhaust gases from engine-driven electric welding equipment; (d) or oxides of nitrogen formed by the effect of intense welding heat on the constituents of air.

Electric welding equipment constitutes more than an ordinary hazard to personnel because of the extremely high amperage involved. Welding current flow for manual work varies from 15 to 500 amperes and from 14 to 40 volts, dependent on the thickness of the work, the size and type of electrode, and the welding speed. Currents as low as .025 ampere can cause pain; .100 to .300 ampere for one-quarter of a second can cause ventricular fibrillation of the heart, which is generally fatal; 2.5 amperes or more can cause stoppage of the heart, paralysis, and severe burns.

Under normal conditions, shock to the welder is not likely. With the comparatively low voltages in use, dry skin forms an effective insulator which limits the flow of current. The electrical resistance of the body is reduced substantially when the body is wet. Electric welding should, therefore, be avoided under such a condition, unless additional insulation is provided. Further, where insulation on a cable becomes worn, its resistance is lowered or even lost entirely. Contact with a cable at such a worn part may permit a short circuit to take place. A person in such contact, even mildly wet with perspiration, may be electrocuted.

An electric arc, and a welding flame to a lesser extent, emits intense ultraviolet and infrared radiation. Welders are equipped with welding goggles or masks which minimize the amounts of these radiations reaching the eyes. However, other personnel in the vicinity of welding operations should not only avoid looking directly toward an arc or flame without pro-

". . . . . there are old welders and there are careless welders; but, there are no old, careless welders . . ."

tection, but should avoid looking toward strong reflections from walls, ceilings, or equipment. Inflammation caused by ultraviolet radiation may be extremely painful. The affected person may later find his eyes badly bloodshot and have the sensation that they have been filled with sandlike abrasive.

The hazards indicated so far illustrate certain of the dangers to personnel and facilities. Poor welds may also cause part failure at a later date, possibly resulting in a mishap. Welding may reduce the structural strength of welded parts if not done properly, or if stresses caused by temperature differences are not relieved. The high heat of welding and subsequent cooling may cause internal stresses and distortion of welded parts. Investigation of an Atlas D mishap revealed that a pipe in the system was welded to a control valve. Thermal stresses caused warpage of the valve seat so that the valve would not close.

Welds must be complete but without undercutting. Lack of penetration, undercut areas, or improperly fused surfaces may result in high-stress concentrations or inadequate strength. Inadequate welds will not sustain loads imposed. Spot welds on several Bullpup missiles lacked penetration, so that the missiles broke up after launch.

Melting of metals may change their properties, causing loss of strength or of corrosion resistance. Welding of cast iron causes segregation of carbon in the iron, making the metal extremely brittle and likely to fail next to the weld. Where volatile materials are present, they may boil out under heat, leaving a porous weld. Porous or cracked welds may allow leakage of fluids.

Welds and adjacent areas must be cleaned, both before and after a welding operation. Prior cleaning will remove flammable materials or materials which will make the welds porous. Cleaning after welding is necessary to remove accumulations of debris which might corrode or cause corrosion. Oxidizer leakage in the Bomarc A system was attributed to moisture accumulation in rough areas adjacent to welds in the bottom of the oxidizer tank. Nitric acid in the presence of moisture becomes more corrosive, and in this case, caused eating away of the metal which permitted oxidizer leakage.

Welding is done safely every day. A good welder learns certain precautionary measures for safe welding operations, which he follows until they become a habit. These may be summarized as follows:

Welding on missiles or missile systems equipment or facilities should be performed by qualified welders ONLY.

Welding operations should be performed away from flammable materials. Enclose the welding zone in fireproof blankets or other protective shields when materials in nearby areas may be affected by welding arcs, flames, sparks, spatter, slag, or heat.

Manned fire protection equipment should be available and ready-for-use, and kept close to the welding site.

Take care to prevent acetylene or hydrogen leakage into an enclosed area where it might create a flammable or explosive atmosphere.

Oxygen from supply cylinders should not be permitted to leak into an enclosed space, since it contributes to easier ignition of flammable materials. Keep grease and oil away from oxygen and oxygen cylinders, valves, and regulators.

Flammable and other deleterious materials should be cleaned from surfaces to be welded before welding is started.

The face, body, and hands should be covered to prevent burns from spatter, sparks, slag, or hot metal. Flameproof, heat-insulating gloves should be worn during welding operations. Wet or excessively worn gloves should not be used.

Suitable precautions should be taken to avoid shock from electric welding equipment. Do not stand in water while doing electric welding. Hot electrode holders should not be dipped in water. Do not use defective cables.

Adequate ventilation or respiratory protective equipment should be provided as protection against accumulations of toxic gases.

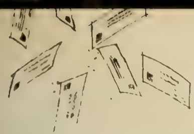
Enclosed areas should be ventilated adequately before a welder enters; if not, he should wear respiratory equipment.

The eyes and skin should be protected against the glare and radiation from a welding flame or arc. Personnel in the vicinity of a welding operation should not watch a flame or arc, and should guard against reflections.

After completion, welds should be inspected and tested to make certain they do not leak and are sound, strong, and clean.

Gas cylinders must be handled carefully; the neck broken from a full cylinder can turn the bottle into a lethal missile! Secure the cylinders to keep them from falling; store them away from the direct rays of the sun and other sources of heat.

There used to be a saying, "There are old pilots and there are bold pilots; but, there are no old, bold pilots." A similar statement would be true for welders: "There are old welders and there are careless welders; but, there are no old, careless welders!" ★



FALLOUT

continued from inside front cover

there is no cabin pressurization until it reaches 12,500, the cabin pressure altimeter can be used for an additional check of aircraft altitude. This altimeter can be checked while passing through about 17-18,000 feet. A reading of about 13,000 means the aircraft is at least as high as the pilot thinks it is, while a reading of 7-8,000 indicates the aircraft to be 10,000 feet lower. Also, a check of the cabin altimeter at approximately final approach altitude is in order. For example, if the final approach altitude is 2500 feet and the cabin altimeter indicates about 12,500, the old glideslope's going to have to be steepened a whole lot to hack the approach.

Granted, the cabin altimeter isn't the most precise instrument ever installed in an aircraft, but it is accurate enough to give a check within a couple of thousand feet at least, and most certainly it will show any 10,000-foot discrepancy. Also, I'll admit that, due to pressurization peculiarities, this method isn't going to work for all aircraft. However, it does provide a simple check that can help minimize a pilot's chances of ending a flight in a ball of fire on penetration turn, or with a flameout after repeated approaches 10,000 feet above the proper altitude.

Capt Richard F. Strohmeier
185 Tac Ftr Gp (OPS) Iowa ANG
Sergeant Bluff, Iowa 51054

BOOTS

In reference to your picture accompanying the article "IFR-VFR Have One," for shame!! Look at the half Wellington bootie!

Capt James N. Heggarty
Reese AFB, Texas

I have just read "Have One . . . But Not the Other," October 1965. The picture on page 2 facing the article, is intriguing. I wonder where the model's boots were issued and I wonder how long they would remain with the pilot during ejection.

Lt Col Richard S. Griffith
Lackland AFB, Tex

These appear to be Probst custom made boots. Herr Probst has built boots for thousands of pilots while they were in Europe. We would expect to see many of them in any fighter operations lounge these days, but will try not to publish a picture of anyone heading toward his bird in them.

MY OWN KNIFE

Concerning the article "Cut With My Own Knife" (September, pg 8), here is a procedure I've used for two years: After coiling the cord (shown in Fig 3), tape one round of Scotch tape around the knife case, over the coiled cord. The tape is easily broken by pulling on the cord (same principle as tearing the cellophane from a pack of cigarettes), and it saves your recoiling the cord each time you change flight suits.

Capt Paul O. Kandt
3750 ABGp, Sheppard AFB, Tex.

The method shown and described in the article does not seem to be the best way to store the knife for immediate use.

Wrapping the cord around the knife, as shown, means that the pilot has to unwind the cord before he can raise the knife above his head and cut the chute risers. The flying suit knife pocket has a small pocket designed into the flap. The nylon cord attaching the knife should be folded and stuffed into this small pocket as shown in these pictures. The cord will then immediately unravel when the knife is withdrawn for use.

Maj John C. Machun
Chief of Safety, Hq 78 Ftr Wg
Hamilton AFB, Calif. 94935

. . . THREE STRIKES . . .

Your October Aerospace Safety Magazine carried an extremely interesting article titled "Two Strikes . . . Three, YOU'RE OUT!" which deals with aircraft voltage regulator malfunctions and an almost non-existent history of U.R.'s being submitted on these malfunctions. Specifically your item pointed out that during a three-year period there were 26 voltage regulators reported on U.R.'s while during a six month period in 1964, 12,600 voltage regulator malfunctions existed. Your article concluded with the remark that . . . Pilots are not reporting or causing this discrepancy to be reported so that the personnel responsible for analysis of such problems can take the necessary action.

This brings me to the reason for my letter, which is "Proper Preventive Procedures." As an example, the Air Force has been flying the T-33 aircraft over 15 years with a very hazardous latching arrangement on the nose compartment doors. If these doors should open in flight, an extremely critical situation occurs. All these years the tech order has been teaching procedures to be used *after* malfunction occurs. Finally one of the using Commands originated a simple modification to the doors to preclude the latches from opening and the problem was solved. I believe a program of "Proper Preventive Procedures" would have emphasized an approach to eliminating the problem rather than living with it and teaching pilots how to cope with the situation *after* it occurs.

A "Proper Preventive Procedure" insofar as aircraft malfunctions are concerned would not hold pilots responsible for initiating U.R. action. The pilot observes the effects, not the cause. The caution light that illuminates in the cockpit may take a trained specialist days to trace, and the pilot may be halfway around the world on rotational duty by that time. The entire discrepancy reporting system is not oriented toward keeping pilots informed of the corrective action taken to eliminate the cause of the problems they encounter in flight. It is not uncommon for pilots in an operational squadron to fly two or more different aircraft in a day's time. An attempt to maintain a record of every discrepancy encountered and its cause, for each flight, by each pilot, would grow to be a task of monstrous proportions.

A much simpler system would be to charge the person that enters the corrective action in the aircraft forms with the responsibility of U.R. action in all cases where flight discrepancies can be traced to a specific component. The U.R. number can be entered directly into the form by the same person, and Inspector personnel can insure U.R. action is taken before signing off the forms. The system would police itself and the personnel responsible for the analysis of such problems would be assured of the data they require.

W. A. Hagarty, Capt, USAF
AFWTR (WTOSO)
Vandenberg AFB, Calif

The author's intention was that pilots should see that such items are the subject of Incident Reports when they meet the criteria in paragraph 4d, AFR 127-4. If the pilot insures that the incident is reported, then a U.R. should be submitted IAW T.O. 00-35D-54. QC people are responsible for U.R. action and we feel this responsibility should remain there.

Aerobits

TAIL HEAVY – Loading of the C-124 with a pair of 2½-ton trucks and a trailer was apparently normal until the aircraft tail stand was removed. The aircraft began to assume a climb attitude sitting on the ramp as the tail began to settle. Power was quickly applied to all four engines and the tail stand re-installed. What had been manifested as empty was a truck that actually contained a full load of assorted materials. During loading the truck's rear enclosure was sealed and padlocked, therefore no one suspected that it was other than manifested.

This has been a frequent occurrence, especially during exercises in which Air Force aircraft have been loaded with equipment prepared for shipment by other agencies. The hazard potential is obvious. In this case, what if the weight had not been quite heavy enough to be obvious and the aircraft had taken off with a big aft CG?

T-34's – SCRATCH TWO – This is kinda hard to believe, but a pair of T-34's crashed within a couple of minutes of each other after taking off in opposite directions from the mid-point of the same runway. Both accidents resulted from the same cause.

No, these weren't Aero Club aircraft, but since our clubs have so many of these birds we thought we'd pass on the bare details. AND, what happened to these T-34's could happen (and has) to many of our Air Force aircraft.

Takeoff was just after 0700. There was practically no wind, so a long runway was used with the aircraft starting takeoff midway from each end. Temperature was 30°, dewpoint 30°, and relative humidity 100 per cent. During the night a healthy coating of frost formed on the canopies and surfaces of the aircraft. This was not removed and was later computed to have added 5 to 10 per cent to the stall speed and an increase in takeoff distance of about 21 per cent.

Other pilots reported that just after lift-off, the situation was similar to flying through prop wash. This was no doubt caused by the ice-coating on the wings. The pilots involved in the accidents could not get airborne and after aborting were unable to stop prior to running off the end of the runway.

SEAT BELTS SAVE A LIFE. Recently, we received an accident report from one of our bases. This accident told us a story. We like to think it proved a point.

A young airman (Reservist) was driving his private automobile to the base during the early morning hours. Suddenly, there was another car trying to occupy the same side of the highway he was using, only it was traveling in the opposite direction. The collision must have occurred in a flash. There were no skid marks on the highway that might indicate just how much time there was. The crash must have made a very loud

and sickening sound as both cars were estimated to be traveling somewhere near the 65 miles per hour speed limit.

Perhaps we will never know why, but the other vehicle had swerved across the center line. The two cars met left side to left side. Both cars were a total loss. Both cars were equipped with seat belts. One driver was using his; the other, unfortunately, was not.

The airman, who was using his seat belt, received only minor injuries — abrasions about the body and a possible concussion. The other man was killed.

We feel that this is a life that was saved through the efforts of the base seat belt program. Seat belts in all private automobiles has been stressed for years at the base of duty for training of the young airman involved and have been available at greatly reduced prices. All personnel have been encouraged to purchase and use seat belts in all their privately owned vehicles, whether they have one or a dozen.

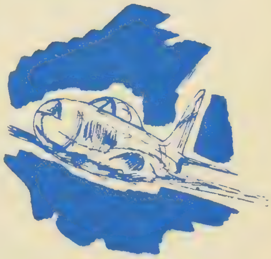
This is the story. We think it proves a point. "Seat Belts Save Lives."

William T. Perry, CONAC,
Robins AFB, Ga

T-33 ICING TESTS — In December, 1964, a Systems Command T-33 landed short of the runway resulting in a destroyed aircraft and major back injuries to both pilots. During the accident investigation the effects of structural, and pitot/static ice on the T-33 were considered. Results of any previous icing tests conducted on the T-33 could not be found, so Aeronautical Systems Division (ASD) was requested to conduct T-33 Icing Stall Tests. The primary purpose of these tests was to determine the effects of various ice accretions on the T-33 stall speeds in the power approach configuration. The secondary objectives were to re-investigate static port icing feasibility and to determine the effects of various ice accretions on airspeed indications. A summary of the ASD Flight Test Report is given below:

- It was found that with an extremely heavy accretion of ice on the aircraft the stall airspeed increased on the order of eleven knots above the ice free stall airspeed for similar gross weights and configurations.
- To induce airspeed errors, icing was carried to an unrealistic degree in order to ice over the static ports. With the static ports iced over, all errors were on the safe side.

AFSC SYSTEMS SAFETY



T-BIRD. Approximately 40 minutes after takeoff, at FL 260, the T-33 flamed out. The aircraft was in level cruise at 96 per cent, in clouds with very mild turbulence. Although there was slight visible precipitation in the form of snow or ice crystals, no airframe icing was encountered and the aircraft had not flown through rain.

The gangstart was activated and the throttle brought to IDLE but the RPM did not increase. The pilot then stop cocked the throttle, notified Center and began a descent. At FL 240 gang start was tried again and the engine started. The RPM went to 26 per cent and stabilized there, but when the throttle was brought from OFF to IDLE, the RPM started to drop. Again the throttle was stop cocked and the RPM went to approximately 30 per cent. When the throttle was returned to IDLE, the RPM dropped and when it was advanced, the RPM increased. The flight was continued at FL 220 but the maximum RPM that could be attained in the emergency fuel system was 96 per cent. The aircraft landed out of a precautionary pattern, the gangstart and engine shut off.

The incident investigator recommended that all T-33 pilots be briefed that a slight drop in RPM may occur when gangstart is actuated and the throttle moved from stopcock to IDLE.

Aerobits

AERO CLUB. The engine of the Cessna 150 quit just after the pilot entered the pattern and was still too far out to make the runway. So he quite sensibly chose to land in a cultivated field. Not so sensible was what put him there and his landing. He allowed the aircraft to touch down nose gear first, which flipped it into its back. Luckily the occupants were not injured.

The not-so-sensible thing that put this pilot in this predicament was lack of fuel induced by lack of judgment. This model airplane normally will fly a little over four hours on a full fuel load. Total flying time for this trip was 4:00 hours. So, with a bit more consumption here and a slight undercalculation of the time there, it is reasonable to have expected the airplane to run out of gas. Sad part was that, at the last landing, 45 minutes from home, the tanks indicated only one-fourth full. Gage accuracy being what it is, fuel indicated versus length of the remaining leg indicates that poor judgment allowed departure on the final leg without refueling.

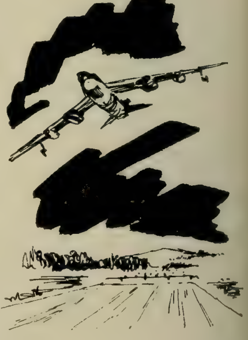
Questions for aero clubs: Do low time (better make it all) pilots understand fuel consumption? Amount usable? And do they allow for gage error? Instructors and check pilots bear a big responsibility to see that these questions can be answered in the affirmative.

B-47. While the B-47 was turning onto final approach, the tower operator transmitted a 16 to 25 knot crosswind component from the left. The tower officer then personally added a caution to "Keep the left wing down." This was acknowledged by the aircraft commander, "Roger, it's down."

The aircraft touched down first approximately 3000-4000 feet down the runway, to the right of the centerline. Contact was made nose gear first and the aircraft bounced back into the air. Several more bounces followed and the pilot, believing that he would not be able to keep the aircraft on the runway, initiated a go-around. The aircraft left the runway to the right and the right wing struck the 4000 feet to go runway marker. Shortly thereafter the Nr 6 engine and right wingtip contacted the ground. The aircraft then heeled to the left and the left wingtip and Nr 1 engine contacted the ground. The left inboard engine strut bent which caused a piece of the strut fairing to depart the aircraft at taxiway Nr 4. After crossing this taxiway, the aircraft became airborne for the last time and assumed an excessively nose-high attitude at an airspeed reported to be 110 knots. The left wing dropped and the aircraft struck the ground, left wing first then forward main gear and nose section. The violent impact caused severe aircraft break-up and fire. The final impact point was 100 feet from the end of the overrun at the takeoff end of the runway, to the left of the extended centerline.

Two crewmembers received fatal injuries in this mishap.

Pilots landing in near maximum crosswind conditions must be prepared for such landings or proceed to an alternate airfield. Radio navigational aids such as GCA or ILS must be used as a guide on the approach to prevent landing long. If a go-around is required, very careful but positive control and power inputs are required to maintain directional control until flying speed is attained.



★

Lt Col David J. Schmidt
Directorate of Aerospace Safety

☆U.S. GOVERNMENT PRINTING OFFICE 1965 201-212/3

WELL DONE

CAPTAIN JAMES W. ANDERSON

27 TACTICAL FIGHTER WING, CANNON AFB, NEW MEXICO

The Pacific island was under the effect of a typhoon when the flight of four F-100's arrived. This was the second leg of a deployment and winds made fuel a problem. With no alternate available and Captain Anderson's TACAN and ADF inoperative, the element he was in started a RAPCON approach. Radar contact was temporarily lost but re-established in time for a GCA handoff. However, the element leader failed to follow GCA instructions.

Captain Anderson realized his leader's UHF was out and took the lead. Due to the time lag, this left the element much too high on the glide path. On the missed approach, with 750 pounds of fuel, Captain Anderson's UHF transmitter went out. He re-established communication by using the emergency squawk and IP button on the IFF/SIF and the element was directed to final approach. To conserve fuel he held the gear and flaps until two miles out, and at precision approach minimums, with insufficient fuel for another approach, continued following the controller's directions, finally observing the runway lights less than a half mile from touchdown. A successful formation landing was completed in a heavy rainstorm.

Captain Anderson exhibited great presence of mind and proficient airmanship under extremely adverse conditions. WELL DONE! ★

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FLYS

AEROSPACE
SAFETY
UNITED STATES AIR FORCE

JANUARY 1966

TAKEOFF

see page one

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AEROSPACE SAFETY

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AFRP 62-1 JANUARY 1966 VOLUME 22 NUMBER I

FALLOUT

WHERE THE ACCIDENT BEGINS

The article "Where the Accident Begins" (November issue) describes the optimum glide slope for all types of jet aircraft. Visit a SAC base and watch a bomber or tanker making a GCA for a full stop or touch-and-go. The pattern is identical to the flight path you have described (i.e., departing the glide slope when transitioning from hooded to visual flight).

If you can locate a copy of the Visual Glide Slope tests (published by FAA, NAFEC, Atlantic City, N.J.), you will find graphic proof that the glide slope is departed between 100 and 200 feet. The tests include every type of modern aircraft both civil and military.

There is no question in my mind that moving the GPIP closer to the threshold will cut down on undershoot landings. I you should meet a "Doubting Thomas," take him out on the overrun of any airfield; the number of tire burns short of the runway threshold will open his eyes very quickly.

Maj Robert R. Hall
Director of Safety
Hq 810 Strat Aerosp Di
Minot AFB, N.Dak 58703

* * * * *

Your article "Where the Accident Begins" was fine as far as it went, but why stop with a discussion of the instrument approach? What about VASI? Since the system was first installed at Eglin I have been fighting a losing battle attempting to convince non-fighter people that the VASI approach was not for fighters, using essentially the same data that you did (The F-4 is excluded, of course.) A few kind words for the anti-VASI fighter pilots would be appreciated.

Frustrated Fighter Pilo

* * * * *

The article "Where the Accident Begins" is an excellent article but I would like to urge some caution on implementing the conclusions.

The conclusion shown in Figure 3 is tha the standard glide slope is 60 feet above the desired landing profile at a distance o 3000 feet. The reader might naturally decide that if this is true, the best procedure would be to hold 60 feet low on the glide path. I suspect that many pilots already are doing this.

Now, if the staff planners move the glide path intercept point closer to the end o the runway, a hazard develops. The pilot who fly 60 feet low would now be 6 feet below the desired landing profile an may have a terrain clearance problem during the final phase of the approach

Let's move all the GPIPS at once or els not move any. The average pilot will neve know whether the GPIP has been move or not and may get in trouble. Of course theoretically, he should never fly the lowe safe limit or below but experienced, rea world pilots approaching a short, wet run way are going to fly on the low side.

Lt Col Gerald T. Rogers
APGC (PGOZF) Eglin AFB, F

The response to this article has been bit surprising—several calls in addition t letters. We learned that: (1) All aircraf with high approach speeds have the sam problem; (2) SAC Flight tested the B-5

continued on page 28

TAKEOFF

We still lose an occasional bird on takeoff because the pilots do not really know what to expect from their aircraft under strange or unusual conditions.

We had three classic examples of accidents in 1965 that should not have happened.

One was an F-100 on a high altitude, heavy weight takeoff. Acceleration was slow, apparently slow enough to worry the pilot. When he rotated—at proper speed—he watched the airspeed meter closely. He said it froze—stopped cold at rotation speed. He had not perceived any thrust loss, nor did his instruments indicate any trouble to him. But it didn't feel right and it apparently wasn't accelerating, so he aborted. He broke through the MA-1 barrier and bashed the bird.

Another was a T-38 abort accident, wherein the student pilot applied all of his training so precisely that he embarrassed our education and training system. This troop had calculated everything to a tee. He had an aiming acceleration check speed of 117 knots, and a firm reject speed in mind. At his estimate of the 2000-foot mark, he was 17 knots short of his aim speed. The pilot aborted—exactly what he had been briefed to do under the circumstances.

The accident itself stemmed from his inability to stop in time, with a barrier failure figuring in the reasons why. The pilot bought the blame all right; he wasn't fast enough in implementing his abort decision. But the corrective action was to put up marker flags to provide a true reference for the start and finish of a 2000-foot acceleration check. This would seem to prove that there's no sense in teaching people to use a 2000-foot check unless you also provide them with a practical 2000 foot speed trap.

The third accident involved another type of scare—buffet on takeoff. This was a T-33 with which the pilot had no complaint until he rotated for liftoff. When he did, it felt like it was stalling. He lowered the nose and checked his speed. It read 120, but he left the nose down until he read 125, then rotated for another try. It wanted to fly, but it was buffeting as though it were stalling. Not having an acceptable explanation for this serious symptom, he aborted. Same story on the stop.

Let's analyze this one first while the situation is fresh in mind. We know of only one set of circumstances under which this type of accident can occur. This is when the pilot is nervous and is behind rather than ahead of his airplane.

There are any number of things that can put a man on edge and that's all we want to imply here—that something was bugging the pilot prior to rotation.

Whatever the background, when the pilot rotated, he felt buffeting and it felt like pre-stall buffeting to him. So he treated it like pre-stall buffeting and aborted because he could neither correct nor explain it.

Now we're going to suggest that what this pilot felt was speed board buffeting. That's the only thing on a T-33 that feels anything like pre-stall buffeting on takeoff. Yes, we know that this buffeting is so light at

. . . You haven't done a thing until you compare what it should take w

rotation that you'd hardly notice it—we've been there, too. But we've never had it happen when we were scared, and that can make a big difference.

Anxiety comes from doubt—which is the same as saying that the unexpected induces fear. If this pilot, or the others it has happened to, had been confident of their status at rotation, this minute buffeting could never have spooked them.

This confidence we speak of comes from the normal and proper series of events and checks that precede rotation. If a man is paying reasonable attention to things like his weather briefing, the filling out of his 175, and the starting and runup symptoms of his bird, he has a good feel for what to expect. If his situation is unusual, such as flying out of Buckley, Colorado Springs or Albuquerque for the first time, the average pilot would be checking things more closely than he might ordinarily. Certainly, he will pay attention to his acceleration check.

Now if all of these inputs have been received and stored in an open mind, and if each symptom and check has registered an O.K. in that mind, then the pilot is proceeding in confidence. A symptom like buffeting would cause him to think all right, but the thinking process would be precisely opposite to that of the man who begins his analysis from a basis of complete surprise or anxiety.

The pilot who is ahead of the situation *knows* that the airplane is all right, so he starts looking for silly little things that he might have forgotten, things that could account for the undesirable symptoms.

The pilot who is behind the bird—or just not with it in this particular instance—has to base his decision on the symptoms alone. He doesn't have six or eight O.K.'s fresh in his mind to temper the shock of a negative symptom. It may even be that he has a few prior negatives stored there instead.

Suppose, for example, that the bird he was flying really was something of a dog. Suppose he had had trouble on a previous takeoff or approach and suspected that his airspeed indicator was less than accurate. Or that previous accel checks had been low. Or that the engine had made strange noises. Or that he was the type of guy who never bothered with fine details but often wondered what would happen to him in a pinch.

Whatever the specifics in any particular case, a thing like speed boards—or an overheat light—or a rumble—or jet wash—or runaway trim—or open gun bay doors—or a blowout—can break up a pilot who is behind the bird, but be a profitable incident to the one who *knows* what's going on.

Everything said so far applies to the F-100 as well. But in fairness to the pilot, we will point out that our system does not contain adequate education and training programs to assure that all pilots get all necessary facts before they are turned loose. We'll show you what we mean.

Your Flight Manual is your only source of factual data. And it is data oriented. Everything you have to know about takeoff performance is presented in two charts; the takeoff ground run and the normal acceleration charts.

These charts provide quick reference answers to very complicated questions, but the answers don't do a thing for you unless you understand exactly what these calculations are telling you. Let's use an example.

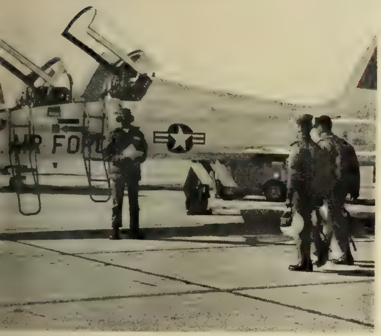
You're an average sea level pilot from an average base. That means your base has from 10,000 to 13,000 feet of runway and an elevation of less than 1000 feet. The only variables you normally face are temperature and humidity, and gross changes occur only seasonally rather than daily. For all practical purposes, your airplane will perform today exactly like it did yesterday. You don't really have to calculate anything. You have a good "feel" for performance at your home patch. You know that you'll have X knots as you pass mobile, or as you pass the 2000-foot stripe or marker. You know the bird will be ready to fly as it reaches the mid-field turnoff or some other familiar reference point. You know that if you're on a max gross takeoff, it's going to take a little longer. But most important, you know that you've got more runway than you'll ever need, so you have no need at all for computing precise takeoff data. If the engine runs, you'll make it off. And if the engine is so bad that there is an obvious extension of the roll, you'll have them look at it when you get back.

The biggest trouble with flying by feel is that it can become too much of a habit. Most of us are so sharp we can walk into base ops after an RON, read the pressure altitude and runway temperature off the forecaster's board, write down the takeoff distance and check speed, then confirm it by a quick reference to our checklist charts. And what's more, we can make it good with the aircraft. That is, 98 per cent of us can, 98 per cent of the time.

About two per cent of us get trapped by this eyeball technique every year. We don't all prang, but we all get a thrill. We get to see and feel things we've never seen or felt before, like seeing the end of a runway coming up and feeling that the bird isn't going to hack the necessary 30 knots in the few remaining feet of runway.

This can only happen under one specific set of circumstances. It can only happen because we failed to draw an accurate picture in our mind of what our takeoff *should* look like, so we could compare it to what it *does* look like as it progresses. In other

at you have available.



Student pilot aborted takeoff in T-38, missed barrier, had accident. Accel check marker may have prevented this mishap.

words, if we *know what to expect,* there can be no real surprises.

It isn't enough just to calculate the takeoff distance and write it down. You haven't done a thing until you compare what it should take to what you have available.

Suppose you were to stop at Buckley (Denver) for fuel on a cross country. Just how impressed are you with the difference in takeoff performance that will exist when you leap off?

They have two runways there, one is 8000, the other 11,000. Normal ground run for a T-33 on an 80° day would be about 6500 feet. The 2000-foot accel check speed for a 6500-foot run is 75 knots. The Handbook allows a 10K-tolerance on check speed, unless this would extend your roll past 90 per cent of the runway length.

In this case, a 10-knot discrepancy at 2000 feet would extend your ground roll by 2500 feet or so. Did you get that? You couldn't even accept standard tolerances on an 8000-foot runway, and a 10-knot discrepancy at 2000 feet will push your takeoff distance out to 9000 feet or more.

What does that mean to you in terms of feel? Have you ever sat out a takeoff run at half of normal acceleration rates? On a normal summer day at home—a 90° day—you'd expect 88 or 90 knots at 2000 feet and you'd be lifting off at 4000. At Denver or Colorado Springs, you'd have from 85 to 95 knots at that distance and have 4000 or more yet to roll. Do you have any idea what it feels like to gain only 5 knots in 1000 feet? Particularly when you're looking at the end of the runway?

The answer to these questions is important only to people who depend on the eyeball system. They are least impressed by the charts and most impressed by the dynamics of experience.

These are the guys who start pulling on the stick as the barrier comes into view. By the time they get 100 knots (in a T-33) they've got a tail scraping attitude — which means they have halved an acceleration rate that was already half of normal. Now they can look at the airspeed meter for 5 full seconds and it will advance only three knots. Meanwhile, another 1000 feet will go by. If you had a five knot gust coming down the runway, it could quit at that moment and make you believe you lost two knots over that 1000 feet. That's more than a man can take unless he's very well prepared for the traumatic experience of a high altitude takeoff in a thrust marginal airplane.

The responses to such situations have been many and varied. Some abort, some press on and settle back down as they retract the gear. At least one T-33 rolled 9000 feet at Buckley, had two-pilot confirmation of 125 knots, climbed to better than 50 feet, then settled right back down on the overrun because it "felt like it was stalling." The dive boards were down when this bird touched down. That's a fact.

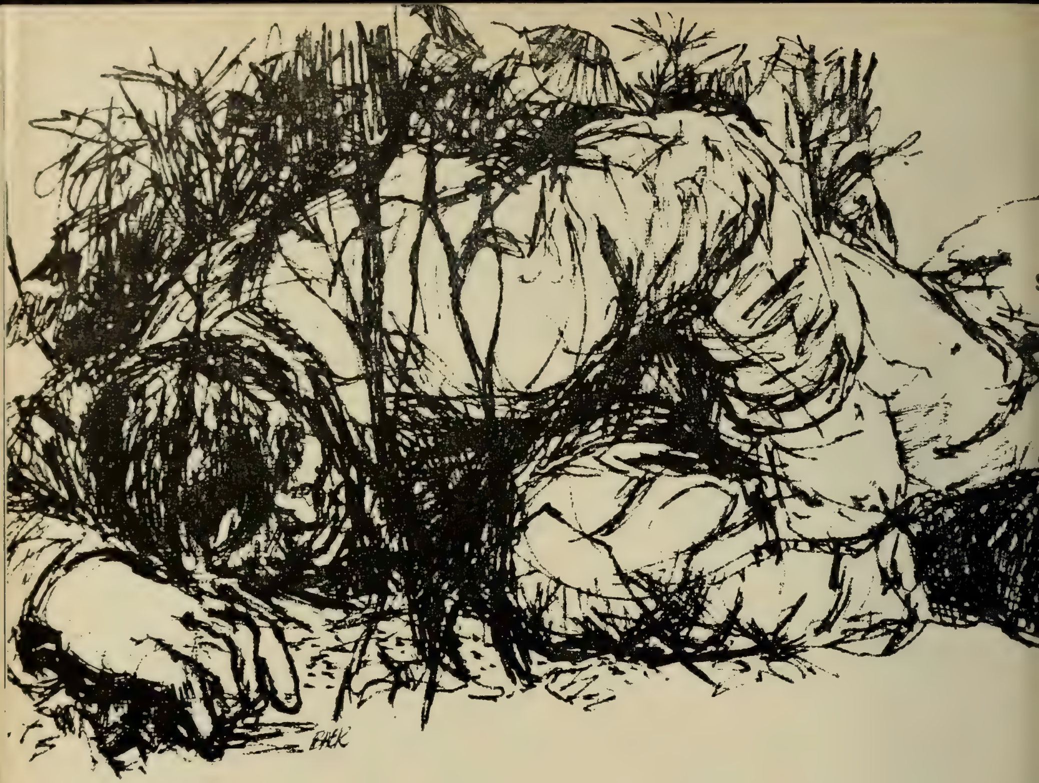
In the case of the F-100 this year, the pilot rotated and checked his airspeed. He said it wasn't accelerating. What happened, we suspect, was that his eyeball computer gave him a reject signal because he had neglected to reprogram it for a tense situation.

Had he looked up the facts (and understood them) he would have had two positive performance checks and an air of confidence to protect him from the shock he got at rotation. He would have known what EPR to expect, and it would have been confirmed prior to roll. A 2000-foot acceleration check would have reconfirmed the engine performance and also told him what to expect at computed takeoff distance. If the accel check is low, the roll is going to be longer.

Finally, even our Handbooks warn us about the price of early rotation and over-rotation. That's the worst thing you can do under these circumstances, even though perhaps the most natural.

As for the T-38 pilot, we sympathize with him. He represents the other end of the spectrum. He was not yet free to use his head; he had to go by the book. He had the accel check data cold and the abort decision came right straight from part 2 of appendix 1. His only trouble appeared to be that the performance charts don't make a sufficient allowance for switching from the page on takeoff to the page on aborts.

This points up a cute little paradox for us as we become more and more professional. Our training programs demand more of procedures and less of judgment, while reality demands exactly the opposite. ★



Survival is a subject that has been written about, talked about, taught and demonstrated until it would seem that every Air Force aircrewman ought to be an expert on it. In fact, many pilots have attended survival school on a ratio of something like four or five times their number of years of service. There are arctic, tropic, desert and sea survival schools in the various commands plus base schools and the big one at Stead. So what can be said that's new?

Let's look at this subject a little differently, not with the idea of putting the schools or the experts out of business, but with strict realism. First a slight review: many aircrews attend survival school one or more times a year. How much do they remember of what the instructor taught and showed them? This, of course, varies with the individual, and we're pretty sure that retention ranges from practically nothing to some lads who have stored in their craniums almost all they were taught.

Instructor ability certainly has something to do with what the students remember. Interest is another factor. Too many of us still have the "it can't happen to me" attitude, and since it doesn't happen to very many, who can argue with this too much? Then when the student is taken out in the boondocks to "live" a survival situation, is he really motivated as to the possibilities, or does he merely reflect on the discomforts and look forward to returning to civilization?

There may be no typical "survival situation" but since it's winter, let's consider a hypothetical case based on situations in which real people have found themselves. After bailing out, our subject lands in a cold, remote piece of real estate well off the main street of civilization. It's a pitch black night and the wind is blowing snowflakes horizontally across the wilderness. Let's say our subject is sound of wind and limb but somewhat clanked up. He's alone, uncomfortable, apprehensive and convinced that he's the only human being within 50 miles. Now there are a number of actions that he can take, some of them foolish.

Here's where we want to get a word in. Land survival today, assuming you are not in a combat zone, should not be as complicated as it was a few years ago. On land, over one half of all survivors are rescued in less than one hour. There have been only 37 cases in recent years when the survival time exceeded 24 hours. (This applies to Air Force crewmen only.)

So what's the problem? There are two people who can make or break you under survival conditions. Number one is you — the guy with the problem. The other one is the personal equipment specialist. First, let's consider you.

Man has been surviving under the most adverse conditions for thousands of years and he continues to do so today. Animals do quite well in the most severe climatic conditions. So why can't you? Agreed, if you were to be stuck stark naked

ten attributed to knowledge, will to live or Act of God. But how about the battle of....MAN AGAINST HIMSELF

into the arctic wilderness with no tools to work with, your chances would be pretty poor. But that is not the way it will be. You'll have clothing — the amount and type to be decided by you alone — you'll have a parachute, a survival kit and a certain amount of know-how gained during attendance at the aforementioned survival schools.

As for the survival kit, it contains many items, most of which you probably won't need. If you've got an ounce of brains — and we're convinced you are really a pretty smart guy — you'll be dressed for the climatic conditions in which you are flying. Then, the frosting on the cake. Although not all of us have the URT-21 locator beacon, most do who are operating in cold climates. This little goodie can and probably will be the major factor in determining how soon you'll be rescued. Then you've got another radio, probably a URC-11. It, too, will come in handy, as a beacon or for voice communications with rescuers. But don't do as one pilot recently did — have them both going at the same time. Conserve one of them, preferably the URC-type and keep it warm inside your jacket until you need it. Meanwhile the URT-21 can be beeping its message to the people looking for you.

To go back a bit, be sure, if it's at all possible, to let someone know your situation. Get off the MAYDAY as soon as possible after recognizing your emergency. Usually there's sufficient time. And give as accurate a position as possible in case radar doesn't have you.

Now there's a lot of good stuff in the survival kit for an extended stay in the wilderness, so we are not knocking the kit or any of its contents. But Rescue will probably have you out of there so fast that you won't need many of the items in the kit. This is not to say, however, that you should leave the kit behind.

Now we know it sounds kind of ridiculous to tell a man who's scared, cold and lost to remain calm. But if you really think about it, before the emergency happens — like right now — we think you'll agree that keeping your senses and not panicking can mean the difference between life and death. This was very tragically demonstrated only a short time ago and it cost us the lives of two crewmen to learn this lesson. Why not fix in your mind right now that, "if I find myself in a survival situation, the very first thing I will do is fight off any panic and impulse to act without first reasoning out what it is I want to do." If you can do this, your battle is practically won. Then if you can simply manage to keep warm, you've got a real fine chance. This applies whether you are intact or injured. If you are injured you'll be uncomfortable, and it might be more difficult to regain your composure. But fight for it, and this goes back to pre-planning and implanting in your own mind the idea that panic is your worst enemy.

Food and water are, of course, necessities of life. But if you miss a few meals, you won't die. In fact, you can go for quite awhile without a bite to eat, and water won't become critical for a couple of days. We realize there's food and possibly water in the survival kit, but again we don't think they are really necessary very often.

We said there were two people primarily responsible for your survival. Number two is the personal equipment man. The biggest thing he can do for you is make sure your radios are in working order when you leave his shop. If the radios are no good, then you might need everything you've got in that kit and then some. But with the URT-21 going for you from the time your parachute opens, and the URC available on the ground, rescue has been reduced to a fairly simple process. So has survival, because you probably won't have to endure a hostile environment for very long.

So what have we said here? Nothing new, we admit. But we wish we'd said it a couple of years ago, before two crewmen died on a cold winter night within a few hundred yards of homes where help was immediately available. ★

UP OUR WA

Capt John S. Kranz, 317 Fighter Interceptor Squadron, APO Seattle 98742

Up here in Alaska, we get about as much snow, nasty weather, frigid temperatures, and the whole nine yards of winter problems as anybody. But let's be honest — winter conditions produce pretty much the same problems at your base as they do at mine. There may be a difference in degree, but, by and large, the cold season bugs us all in the same stubborn areas.

We haven't learned how to change the weather yet, but over the years we have learned to live with really severe conditions. And not only just live, but we've gotten to the point where there's a pretty respectable operation going on.

The difference between success and failure, hack or no hack, often depends upon a series of individually minor procedures. But the point to keep in mind is that where winter is concerned, you tend to find out real fast if your procedures aren't adequate. Our experience with arctic conditions has led to most of our winter operation procedures. Where we didn't have to learn the hard way, good common sense guided us. And in those areas not covered by either experience or common sense, we're still learning.

So how about comparing notes with me? I'll lay out the way we do it, and you take a look at how it compares with your operation.

The first commandment in winter operation is "Plan Ahead." You just can't do things as easily as in warm surroundings. Make what you do count. Allow time for delays due to adverse conditions. This includes such considerations as leaving home in plenty of time to get to work. If you are thinking that's a pretty simple concept, I agree. But each year a lot of jobs never get started because we are hurrying to "get at it."

A big part of Plan Ahead is represented in what you wear. If you are flying in a hostile climate — dress for it. If you have to be outside, why not be comfortable? If you were dressing for a hunt or even, perish the thought, ready to start a cold weather survival trek (school style), you know darn well you'd lay on the clothes. There really isn't much difference. You never know when it may be your turn to survive in the tules. So be ready for it.

O.K., we're off to a flying start. We gave ourselves plenty of time to get to work, and we are dressed for the conditions. Now let's examine our procedures affecting the flying operation.

The Dash One contains a wealth of guidance in the cold weather operation section. Nothing beats a good preflight inspection, but remember what happens to your preflight when your rear end is freezing? Right, so include that bit of personal experience as justification for the bulky but warm form you create on the ramp. You can anticipate delays, such as low struts, snow and ice removal, seals leaking, and frozen starters. But while you are checking the bid, also be watchful for frostbite on yourself and others. In a nutshell, make a good preflight and don't rush yourself into accepting a potentially bad situation. We all know how true it is that a good preflight is the only safe way to begin a flight. In the winter, when everything seems aimed at making life miserable, we emphasize the preflight inspection. How about your operation, and how about you?

Incidentally, there is no reason why you should accept an aircraft ladder that doesn't have anti-slip surfaces. More than one jock has found himself out of a job because he slipped off a ladder. Eliminate this real hazard.

Let's look at our aircraft taxi operations. All of us who have had personal experiences with cold country taxi problems may join in a chorus of Amen. If you don't think there's much skill, procedure and luck involved in handling certain winter ramp conditions, I humbly suggest you haven't been there. This can be one of your roughest winter problems. We often have RCR readings as low as 04, and occasionally less on our airfields. Under these conditions, you must do it right. You've got to take it easy. Keep in mind that when the reading is low, you have only a small percentage of the control over the aircraft that you are used to in normal conditions. You can't stop very quickly and sometimes you wonder if you can stop at all. Don't depend on brakes for directional control. With most of our birds, you only succeed in sliding a wheel, instead of turning a corner. Nose wheel steering is your best bet, but it's not very difficult to lose control here by sliding it also. So we have these rules. *Take it slow. Be smooth. Enter a turn gradually. Don't jab the brakes or steering or you'll "break loose."* If your bird starts sliding in the curves, you know you're too fast, and too late. It's better to shut down than ride it out at idle. Chances are you'll stop quicker by eliminating even idle thrust. But better yet, don't get all bent out of shape in the first place. The real pro knows when to creep.

Remember there's no judgment involved in sliding off a taxiway. It all depends on how you set it up. There is a point beyond which we don't operate. When the ramp is presenting an unacceptable hazard, we don't fight it. Stand down. If your operation can't afford this luxury, you may have more problems than just winter weather. Chances are you can make the time up later — safely.

Here are a few procedures that we use:

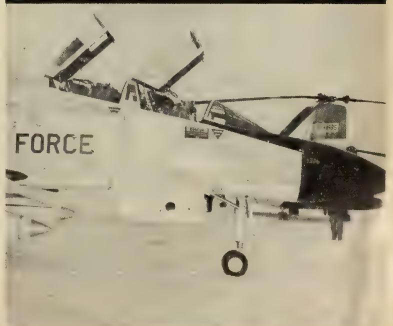
- Minimum spacing of 300 feet between taxiing aircraft.
- Use emergency fuel to lower idle RPM.
- Go *slow* and be extremely alert.

When taking the active runway, you may anticipate really slippery conditions. The surface has been heated by engine runups in takeoff position and then cooled down again after departure. It all means one thing — ice. We normally have the leader of a flight of two take the inside of the runway. Then if the wingman slides, while getting into position, he doesn't slide into the leader. And don't forget to have wing tip and nose tail clearance while you're at it. To prevent a swing into the leader by the wingman during runup, we hold off on wing runup until the leader has gone. A snow or ice covered runway is no place to practice formation takeoffs. The odds are all bad. You can't get a good runup, usually, because the wheels won't grip at full mil. If there is much crown to the runway, you tend to slide if you get over to the side. All things considered, it seems unnecessarily risky. We don't do it. The leader, however, must not run up his engine until the wingman has passed behind and is clear. It is bad form to blow ice and snow at your friends. After the lead aircraft rolls, watch out for reduced visibility. The engine exhaust can turn out pretty good ice fog if the conditions are right. And as the exhaust blast is pointed down during aircraft rotation, snow clouds or alcohol mist are usually formed. Depending upon crosswind, all of these phenomena can block your view completely. Wait until your path is clear before rolling.

It's when the pitot heat doesn't work that we realize how nice it was. It's when the canopy is iced over that we remind ourselves to check the anti-ice and defrost system before each flight. In winter weather you can expect to need your all-weather accessories. From experience you know that once an icing condition has started, it takes more time than you like to clear it up. Super cooled canopies and windscreens react very slowly when you turn the NESA and canopy anti-ice on—after the fact. So check the systems before flight and then use them to prevent ice and frost accumulation. Keep an eye out for throttle icing. Move the throttle occasionally, especially during penetration, and if it feels like it's stiffening, select a power setting that will bring you home. Watch your fuel feeding. Who needs surprises when you're 400 to 500 miles out? Stay on top of the situation. Get behind and the penalty can be pretty severe.

I always plan on going to an al-

Planning is the key to safe winter operations. Allow time for delays. Slick runways, taxiways, and ramps present hazards that can be overcome only by extra care and knowledge of procedures and equipment.



UP OUR WAY

continued

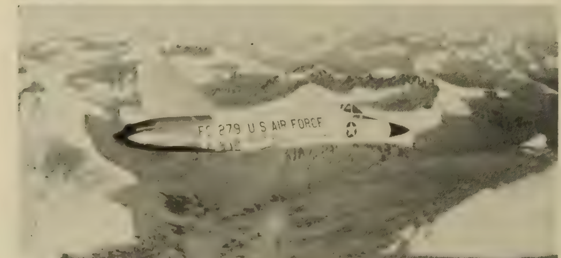
ternate. You've heard that statement before? O.K., but let me explain. In our particular situation in Alaska, of the fields suitable for jet operation, the shortest distance between any two is 222 NM and the longest is 440 NM. Obviously you don't make a missed approach, point toward an alternate and use that few hundred pounds extra you've saved for mother and the kids to squeak you through. No, you've planned your fuel, expecting to divert. The point is this. The same factors — fog, wind, snow storm, barrier engagement, blown tires, or an accident — that can close my runway can also close yours. Expect the worst, and you can handle it. And I'm sure you agree that if alternate fuel is available but not required, there are a lot of practical uses for it. How about your GCA's? Do either you or the controller need any practice? You can find a good use for that extra fuel.

Keeping tabs on the current and trend weather at your destination and alternate is just plain good sense. Why then isn't it also good sense to be current on your published missed approach? It is, of course, yet each year we read about a ding, probably caused by lack of familiarization with the chart. It's rough trying to make a missed approach while reading it at the same time. Again, we can refer to our original concept of plan ahead. Know your field.

Regardless of the type of landing pattern, whether overhead or box or straight-in, the object is to get the bird on the ground. In the grip of winter, however, the problem often is how to get stopped. If your field is short, and some of ours are mighty short, you rely on the best technique you can muster to put her on. To get really good, and that includes consistent, results from a short field approach or minimum run landing requires practice. You are flying a lot closer to max performance curves while executing the minimum run maneuver than you normally experience. Changes in gross weight are much more noticeable. The margin of error is smaller. Simply stated, it takes a bit of skill. So give your minimum run landing some practice before you really have to use it. Get a good idea what it feels like at various gross weights and configurations. Do you have much float when you chop the power? To find out where you will touch down at minimum airspeed from a given approach airspeed, try it first on a long runway and use a point well down the actual runway as the "foot one" of your short field. Unless you have been doing minimum runs right along, I think you will be surprised. I know you can spike it on, but that's not what you're after. Remember, roll-out distance is a function of touchdown airspeed. Work for the right airspeed at the right place. Aim well down on your practice minimum runs since you inherently are much more susceptible for a short landing as you approach the optimum. It does take skill and hard work. Respect the recommended Dash One procedures, and you'll find the minimum run landing really works for you. Ignore the cold hard facts of aerodynamics and you are in trouble. The goal we shoot for is the time that our drag chute fails, and we know the landing is as good as we can do — even if we had planned on not using the chute.

There are bound to be occasions when everything turns sour. To ignore this fact is to ignore historical data. We've all faced it, or will face it. Low on fuel, low on weather, short on runway, and looking at a strip of ice. Don't spend precious time in a futile effort to create traction that isn't there. When you're not *sure* you can get the bird stopped, you are a perfect candidate for the barrier. After all, what do you really lose if you call for the barrier? Either your estimate was wrong in the first place and you get stopped prior to the barrier, or you stand a good chance of a successful engagement and save. You win either way. If you kid yourself, perhaps due to false pride, that you can get the bird stopped and don't need the barrier — and pass it up, you are pretty short on options. It is unfortunate when individuals are reluctant to use the barrier for fear of censure. How does your operation approach barrier engagements? It's worth more than a passing thought.

Well, how do our notes compare? Perhaps some of our experience would have to be modified to fit your particular equipment and situation. The philosophy of winter operation, the basic concept, however, should tie in pretty closely. Our objective is safety. During winter, safety is an individual responsibility, perhaps more so than during any other season. ★



Watch your fuel feeding. You don't need surprises when you're 400 to 500 miles out. And always plan on an alternate.

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q. How long can I descend to make a circling approach at a base where circling minimums are published as 400 feet and one mile, such as Olathe NAS or Corpus Christi NAS?

A. Air Force pilots are governed by two regulations to determine weather minimums. AFR 60-16 states that minimums will be as published but in no case lower than those published in AFR 60-27, Instrument Approach Procedures. AFR 60-27 lists absolute circling approach weather minimums as 500 foot ceiling, one mile visibility. An Air Force pilot then must comply with the 500 foot minimum even when the published minimum is 400.

One way to remember absolute minimums as they apply to Air Force pilots is the abbreviation "CATSLIP."

C = Circling = 500/1
A = ADF or VOR straight-in = 400/1
T = TACAN = 300/1
S = Surveillance Radar = 300/1
L = Localizer Only (ILS) = 300/1
I = ILS = 200/½
P = Precision Radar = 100/¼

Q. After level-off at FL 350, my altimeter reads 35,150 with position error applied. Can I now reset the altimeter to read 35,000 for ease in maintaining altitude?

A. This technique is not recommended. Throughout a flight numerous altitude/airspeed changes may be required. Each change would require the pilot to reset his altimeter to 29.92 plus or minus pre-takeoff altimeter corrections, accomplish the altitude/airspeed change with the altitude adjusted to compensate for position error, then reset the altimeter to read the assigned altitude.

By resetting the altimeter it would be very easy to forget to apply the pre-takeoff corrections to subsequent altimeter settings, particularly during descent through the appropriate flight level and/or prior to landing. There is less chance for error if you maintain the appropriate altimeter setting and indicate the altitude required with the position error applied.

Q. Some TACAN penetrations have a holding pattern depicted with the IAF at the outbound end of the holding pattern, e.g., Westover AFB, JAL TACAN-2; McConnell AFB, JAL TACAN-1, etc. If I am cleared for the penetration and approach but still inbound to the holding fix on the reciprocal of the holding course, can I fly a teardrop to the extremity of the pattern and turn inbound to the IAF?

A. Yes. When using TACAN the teardrop can be flown to the extremity of the pattern. The 1½ minute maximum time outbound does not apply. Protected airspace will not be exceeded since the pattern selection chart contained in ATP 7130.7, Holding Pattern Criteria, provides pattern/template information applicable to both time and DME patterns. When using the tear drop and the holding pattern is extremely long, such as the McConnell pattern (15 NM), you could fly the entire leg length on the 30 degree heading. This may be desirable for aircraft with a high holding airspeed and large radius of turn. However, for slower airspeeds the 30 degree heading (if flown to the extremity of the pattern) would produce more displacement than is needed for the turn to the inbound course. In this situation fly the teardrop until you are adequately displaced, then turn to parallel the holding course and proceed to the outbound limit of the holding pattern.

POINT TO PONDER

In the September 1965 IPIS Approach feature, we answered a question concerning the minimum authorized altitude when flying IFR/VFR on top on airways. The answer given was that AFR 60-16 VFR minimum altitudes would apply if so desired. Additional questions on this subject have indicated that this may not be true in all cases.

For example, in order to maintain the centerline of the airway, adequate navigation signals are required. A flight along airways below the MEA (Minimum Enroute Altitude) could be receiving adequate signal strength; however, this would not be guaranteed. NOTE: Flight below the MEA down to the MOCA (Minimum Obstruction Clearance Altitude) is authorized within 22 NM of the VOR facility or when operating in a radar environment with radar vectors.

In addition, low altitude flight considerably below the MEA could be out of controlled airspace, since the base of the controlled area for airway purposes may be located anywhere from 700 feet above the surface up to 500 feet below the MEA.

If it is necessary to fly lower than authorized IFR altitudes, probably the best answer is a well-planned VFR flight in VFR conditions. ★

ROUGH?

Or is it tough?

Robert Chernoff, AFSC, Eglin AFB, Florida

I've heard tell that flying is rough! But have you ever tried to maintain a roughly flown aircraft? Before you get your hackles up, I don't mean to say that those of you who fly rough are poor pilots. Heck no! Let's face it, if our aircraft can't be flown roughly, then they'll probably not be much use to us under combat conditions.

But there are all kinds of rough flying. There's the man on the stick, who is rough by nature; then there's rough flying caused by turbulent weather; and, of course, there's the infrequent, but most exacting, rough flying demanded during combat.

Whatever the reasons are, let's talk about rough flying — period.

As a rule, the pilot and aircrew have a difficult and exacting job to perform. Aside from the glory, the sense of freedom and well-being that is part and parcel of being airborne, there is the ever-present attention to detail, the focus on the mission and sweating out the variables from the norm that occur ever so often.

Now let's take a quick look at the ground-borne maintenance people. At this point, there are some who are already disdainful; but before you snub your nose, don't forget that this is the crew that really keeps you airborne; this is the team that draws knuckle-blood to keep you serviceable; and this is the cadre that works around the clock to keep you safe.

But you know the ground maintenance people can keep you as safe and serviceable as you want them to. It's true, we have maintenance and inspection handbooks out the gazoo to help accomplish our mission. In fact, there isn't a day goes by that we don't receive an armful of time compliance tech orders to further improve our aircraft. Add to this: flight safety supplements, regulations, SOPs, NOTAMs, bulletins, contractor poop sheets, flying safety meetings, reports and forms. You might say, "Brother, you can't miss!" *But brother,* we *are* missing!

Let's cite only one example, that of a recent flight of a specially and highly instrumented cargo type aircraft. The takeoff and climb out were normal. Twenty minutes after reaching altitude, the countdown was made and the instrumentation went whirring on its merry way. All the specialists were at their stations. The pilot and copilot were intent on their course. The technicians and scanners were making notes, adjusting equipment and punching buttons. Ahead and on the designated flight path loomed the wide swath of a thunderhead. Avoidance was unthinkable — too much was at stake on this mission. Everyone buckled in and within three minutes all Hades broke loose.

For the next five minutes, through sickness and apprehension, the wings flexed like paper. Longitudinal and lateral yaw was so violent that a seat bracket cracked. Next, a large section of cowling whipped by the right scanner's crew cut and gyrated through space like a fledgling duck. As the thunderhead was passed, everyone breathed a sigh of relief and appraised the loss of cowling as a factor which should not deter the mission. At this point, it was discovered that a "key" black box was out of commission. The data essential to the mission was now unobtainable, so naturally the flight was terminated.

After the aircraft had rolled to a stop, the crew returned to their offices very sadly – oh, so sadly. The last man out was the pilot. He wasn't hilarious either. It seems as though it was *his* seat bracket that broke and the seat belt tore the zipper right out of his pants during the peak of the turbulence. The ground crew walked around the aircraft and noticed the missing cowling. Review of the AFTO Form 781 indicated three discrepancies "Cowling lost during flight from number 3 engine," "Computer power supply inoperative" (black box), and "Pilot's seat bracket broken."

Within three hours a new cowling section was fitted to number 3 engine, a new black box was installed and checked O.K. and the seat bracket was repaired. A postflight inspection was completed and the aircraft was serviced and put to bed for the night.

The next day, the same mission was scheduled again. During an apparently normal flight, the left aileron broke away and flapped for a few seconds. In this few seconds, the trailing edge of the wing was battered to a pulp and then the aileron sailed away. Needless to say, control of the aircraft was on the difficult side. By dint and sweat, and certainly by skill, the aircraft was landed safely.

The results of the investigation disclosed that two of the three hinge points for the aileron broke because of fatigue. A look-see at the right aileron disclosed one hinge broken and cracked skin. But how could this be? There were only 14 hours on the aircraft since new! Naturally, further interrogation revealed the one *undisclosed* and *unwritten* factor – "extremely violent turbulence, abnormal forces on surfaces during flight." And guess what. A thorough inspection by X-ray produced the interesting negative of the main spar in the left wing featuring a 30 per cent chord crack. You can bet the flight crew was shocked. Even the maintenance people had visions of a court martial for negligence of duty.

Well, there's no doubt that "negligence" was involved; but who was negligent, and of what? Was it the pilot for flying into the thunderhead? Was it the ground crew for failing to perform thorough maintenance? Or was it a combination? Well, maybe it could be all of these reasons.

As it turned out, the data to be acquired from the mission was critically needed. It was an operation representing an investment of almost a million dollars, besides being number one priority of national defense significance. So, in a way, the aircrew should be commended for their courage.

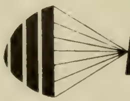
But what about the maintenance gang? There's no doubt that all of their work was above reproach. How could anyone justly demand even the sharpest maintenance crew to expect catastrophic damage, hidden completely from view, on a new aircraft with only 14 hours of time? Yet, there was the undertone of negligence. Would you blame a doctor for incompetence if he could not cure your ailment when you wouldn't even give him a clue as to your symptoms? Sure, if he sticks to it, he can probably diagnose your ailment in time; but sometimes "time" can mean your life!

It's no different in the case of our aircraft. In time, the maintenance "doctors" would have found all the troubles themselves. But in this case, too, time is on nobody's side. Yes, there was negligence—negligence of the pilot to correctly assess his flight and to record proper and accurate entries on the AFTO Form 781. Had he noted, "Encountered extremely violent turbulence. Suspect structural damage," there's no doubt that a thorough inspection of the whole airframe would have detected cracked aileron hinges and many other serious deficiencies.

Your maintenance people can't be detectives and inquisitors after every flight. If they were, you wouldn't even get your minimums let alone accomplish missions. By the same token, they're not mind readers. If you've got troubles, tell them and write them in the forms. Writing it in the forms is like signing an insurance policy. Once you're insured, the maintenance people aren't about to have you killed so that they'll have to pay off. They're going to be doubly sure to keep you safe and alive.

The AFTO Form 781 is there for the pilot to record and for the crew chief to record – for each other's benefit. Use the form. It is the only and surest means to inform maintenance of problems encountered during flight. Accurate and legible recording of deficiencies will permit maintenance to return a better and safer aircraft. ★

THE INSIDE STORY ON.....



DRAG CHUTES

When a drag chute on an F-100 airplane fails to deploy, the control system or door release mechanism is generally to blame. Recently, however, there have been a rash of drag chute deployment failures caused by the chute hanging up on various components as described in the following report excerpts.

- "Upon return from a cross-country mission, the drag chute failed to deploy. Drag chute hung up on broken liner hinge."

- "Drag chute failed to deploy on landing. Inspection revealed that the drag chute pack was snagged on a sharp corner of the drag chute liner door. Sharp edge of door had not been rounded to prevent this type of malfunction."

- "Drag chute failed to deploy. Liner bag caught and hung on a liner box patch rivet. Rivet was not properly seated."

- "Drag chute failed and just the pilot chute deployed. Primary cause attributed to the drag chute deployment bag being hung up on the drag chute retaining spring. The knotted end of the bridle that attaches to the outside of the deployment bag was wedged in the retaining spring."

- "Drag chute failed to deploy on landing. Investigation revealed that one pilot chute shroud line was caught on the cotter key which safeties the drag chute cable to the drag chute risers. This condition prevented main chute deployment. Cotter key was found to be too long and not bent sufficiently to prevent accidental hang-up."

The foregoing malfunctions are the result of improper maintenance and questionable inspection methods. When conscientious effort is spent on the proper adjustment of the drag chute control system to ensure its reliability, it is discouraging to experience a failure just because of a protruding rivet or an overlength cotter pin. Therefore, on the drag chute installation procedure, take an extra minute or so to check the drag chute compartment area for the improper installation of raw stock items such as rivets, cotter pins, etc., which could prevent chute deployment. ★

North American Aviation
Operation & Service News

PERSONAL EQUIPMENT NOTES

THE D-RING IS BACK — If you have taken more than casual note of your parachute for the past six or eight years, you will recognize the picture on the left (A) as that of the old familiar ripcord grip known to many as the D-ring. The picture on the right (B) may also be familiar to a few as the old "mousetrap" between the D-ring and the chest strap ejector snap hook. If you are in a bit of a hurry to get your harness off and clear the bird after a hard day in the cockpit, you may pull the ejector arm on the chest strap and let it snap back on the D-ring. Then, when you reboard without checking your harness too carefully, you can rehook the chest strap without clearing the fouled lever arm.

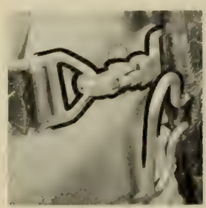


Figure A

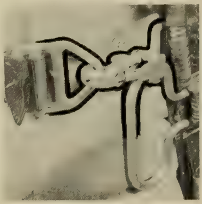


Figure B

By popular demand, the "T" handle ripcord grip is being banished. Although it cannot be denied that the old/new D-ring gives you a bigger and better target for the zero lanyard hook, the return to the D-ring will revive some of its shortcomings. So, until it can be revamped, give it a look and keep it out of entanglement with the chest strap.

• •

INSTALLATION OF THE D-RING RIPCORD — A recent message from a fighter wing points out that installation of the D-ring ripcord in accordance with TO 14D1-2-607, 14 June 1965, does not require a D-ring pull test during the 120-day inspections and repack. Therefore a hazard may exist if the pocket is sewn tighter than the 12-18 pound pull test tolerance. Personnel of the Wing discovered one D-ring that took a 48-pound straight pull. They recommend a one-time pull test, per TO 14D1-2-81, pages 5-17, par E, and Figure 5-15. Sounds like a good suggestion. ★

FAA ADVISORIES

Walter J. Wrentmore, FAA Liaison Officer, Directorate of Aerospace Safety

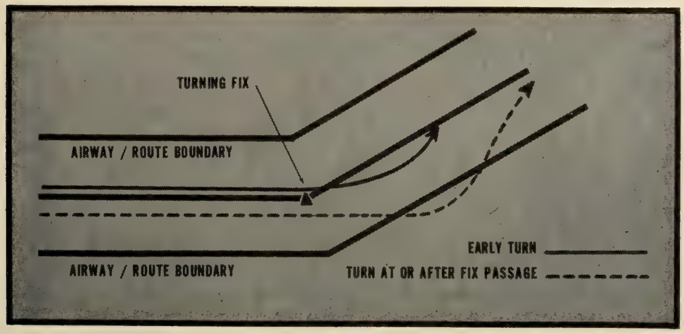
COURSE CHANGES WHILE OPERATING UNDER INSTRUMENT FLIGHT RULES BELOW 18,000 FEET MEAN SEA LEVEL. FAA Advisory Circular, AC 90-28, reminds pilots making course changes that routings prescribed in air traffic control clearances must be adhered to as closely as possible in order that flight paths will remain within airway/route boundaries during enroute and terminal flight operations.

In the development of the two-level airspace structure which became effective September 17, 1964, the Federal Aviation Agency considered the probability of aircraft exceeding the airway/route boundaries while making course changes. The normal navigational aid spacing for airways/routes below 18,000 feet MSL is 80 nautical miles and the airspace area to be protected has a total width of 8 nautical miles, 4 nautical miles each side of centerline, within 51 nautical miles of the facility. Beyond 51 nautical miles the 4.5 degree accuracy factor determines the width of the airways/routes (approximately 2 miles in total width every 13 miles). It was evident that aircraft operating in excess of 290 KTAS could exceed the normal airway/route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turning fix (distance measuring equipment, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway/route, i.e., 4 nautical miles each side of centerline. As a result, the FAA (1) took action to assure proper obstruction clearances for all known turning operations, and (2) provided additional instrument flight rules (IFR) separation protection for turns.

In the airspace at and above 18,000 feet MSL additional IFR separation protection is provided for turns. However, in the airspace below 18,000 feet MSL, where operations in excess of 290 KTAS are less prevalent, the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 KTAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Pilots of aircraft are required to adhere to airways/routes being flown. Special attention must be given to this requirement during course changes. Each course change consists of variables that make the technique applicable in each case a matter only the pilot can resolve. Some variables which must be considered are turn radii, wind effect, airspeed, degree of turn, and cockpit instrumentation. The use of any available cockpit instrumentation such as distance measuring equipment may be utilized by the pilot to lead his turn when making course changes. This is consistent with the intent of FAR 91.123 which requires pilots to operate along the centerline of the airways and along the direct course between navigational aids or fixes.

Turns which begin at or after fix passage may exceed airway/route boundaries. The following illustration contains an example flight track depicting this, together with an example of an early turn.

Pilots are reminded that special attention must be given to the matter of making course changes so as to adhere as closely as possible to the airway/route being flown. ★

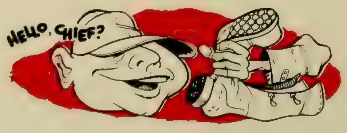


Rex Riley
CROSS COUNTRY NOTES

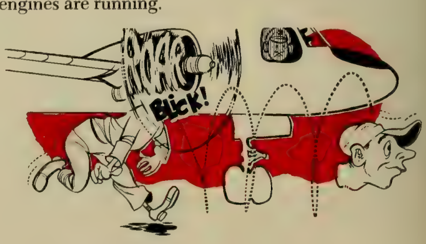
RUBBER BOOT — Because of magazine production lead time, Rex couldn't get this message out as quickly as he wished, but there still may be those who haven't got the word.

A TWX from WRAMA indicated that a rubber boot that should be installed over the switch activating pin of the URT-21 may be missing. Beacons UR'd for this deficiency worked correctly after installation of the boot. Here's what WRAMA advises:

- Failure to install rubber boot in switch assembly is a production quality control problem and will be considered in any future production. As for the Beacon sets already in service, it is recommended that each Beacon be checked to determine if boot is installed in switch assembly. Any Beacons not having boot installed will be removed from service and shipped to FB2065 Robins AFB, Ga.
- Inspection will be accomplished during normal inspection interval of AN/URT-21. Remove the automatic activation button (disconnect the battery if not in a screen room) and determine if rubber boot is in place. This will be difficult in view of the fact that the boot is dark gray in color and partially hidden by the leaf spring; however, the boot has a hexagonal base, part of which upon close observation can be seen underneath the leaf spring.
- Above information is being published as a supplement to TO 12R5-2 URT-21-2.


HELLO, CHIEF?

PEOPLE AND PROPELLERS — Several deaths and injuries during the past few months due to people walking into propellers remind Rex that, although we are in the jet age, we still have this old, old problem. All aircraft engines are dangerous when they are running. Jets will try to ingest an unwary person, the exhaust blast can be fatal, and we all know what props will do. Perhaps the problem is that we who are around aircraft much of the time take these hazards for granted and assume that others are aware of them. To the uninitiated, however, the idea may not occur that a jet can create this suction force, and usually, it seems, victims of propellers walk or run into them without being aware that they are there. Some of these are unexplainable, but often prop injuries occur because the victim had his head down to keep the windblast out of his eyes, or he was in a hurry with snow or rain blowing on him. In any event it behooves responsible people to protect the ignorant and this includes aircrews who allow passengers to deplane while engines are running.



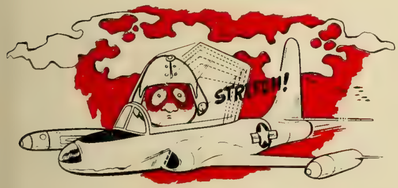
Several incidents and a couple of accidents recently indicate that wake turbulence was associated if not the direct cause. For example, an F-101 pilot was descending through 5000 feet when the aircraft suddenly rolled sharply as a result of flying into wake turbulence from an aircraft that had just departed the base. After the aircraft landed, several items were found to be damaged: lower gear door assembly, 25 per cent missing; MLG strut door, 75 per cent missing; flipper door, 25 per cent missing.

In the June 1965 issue of FAA's Aviation News there was an excellent brief article entitled "The Invisible Hazard – Wake Turbulence." Here are some items gleaned from that article. (The term wake turbulence includes wingtip vortices as well as prop wash, jet wash, downwash, etc.)

Large, heavy aircraft can generate a vortex core with a roll rate of 80 degrees per second. Between the vortices an aircraft could encounter a downward flow of air of 1000 to 1200 fpm. Wing vortices are not generated until the wing produces lift; conversely, when the wing stops generating lift, during landing, vortex formation will cease.

The hazards of encountering wake turbulence are, of course, much greater for light aircraft than for most military aircraft. But some of our aircraft fit in the "light" category and we have had some problems with 0-1s and other light planes encountering wake turbulence. Even some of our fighters have run into trouble lately, at least one on landing, not to mention the F-101 incident related above.

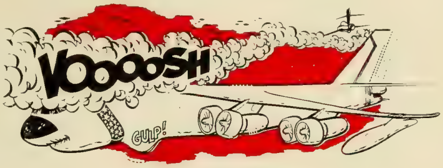
Unfortunately the pilot penetrating for an approach may not know that another aircraft has crossed his flight path within a few minutes. But during approaches and takeoffs other aircraft will usually be evident and the pilot can take the necessary precautions.



PACKAGING – Rex recently received a short item with the recommendation that it be used in this magazine. It told about an incident in which a T-33 pilot picked up a couple of small boxes at an air freight terminal for transport to his home station. He put them in the back seat and leaped off. At about 25,000 feet he looked in the mirror and discovered that one of the boxes had swollen to about twice its original size. Seems this package was in barrier material, MIL-B-131, a moisture-vapor-water proof material that provides de-humidified preservation for delicate equipment when properly sealed.

Rex hasn't heard of this specific problem before, but if it can be a hazard it is worth mentioning. Obviously this package was air tight but the container was not non-expandable. Pilots cannot be expected to know the characteristics of all packaging materials, so it behooves transportation types to use some discretion in shipping such items.

OIL BURNERS – Near misses involving aircraft flying Oil Burner routes are frequent enough to be of serious concern. At these altitudes, the offenders are generally light aircraft and chances are that many of the pilots never heard of these low level routes and are completely ignorant of the fact that the times they are in use can easily be obtained. SAC pilots just have to take it for granted that civilian aircraft will occasionally invade their low level domain and keep their eyes open at all times for this possibility.



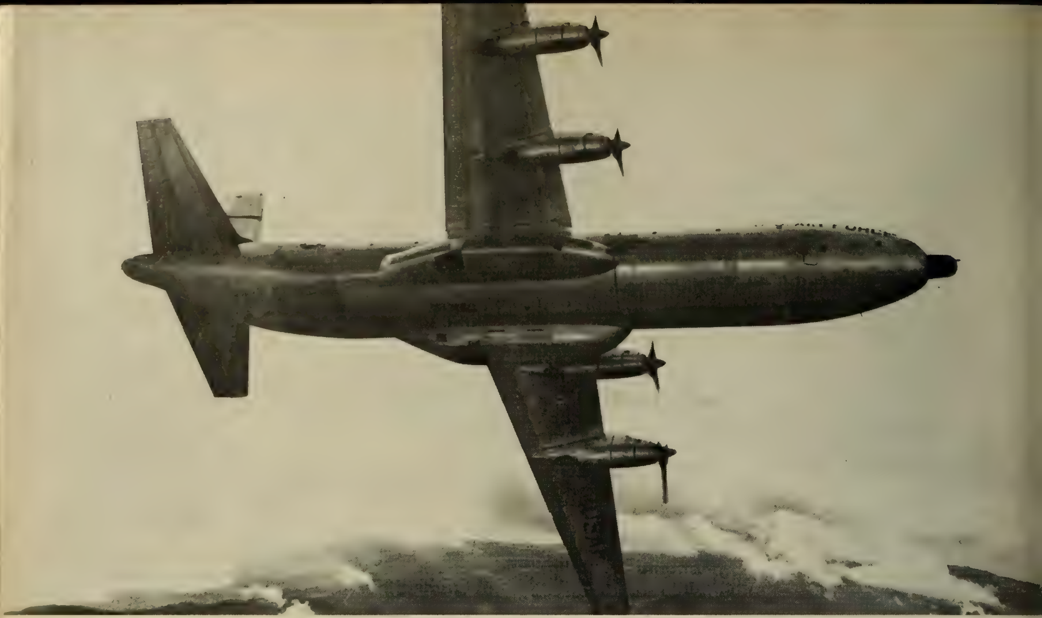
While this is a continuing problem, intrusion by military aircraft shouldn't be. Yet a recent OHR related a near miss between a B-52 and an F-84. The fighter made a sharp turn at about 2000 feet away, but the bomber pilot stated that there wasn't a thing he could have done to prevent a collision if the fighter hadn't turned. Air Force and ANG pilots should be well aware of these low level routes and can easily determine whether they are in use. A collision, or even a near miss, is finding out the hard way.

ACCESS DOORS – Shortly after takeoff, the pilot of an F-102 heard a noise, then noticed that an access door on the right forward side of the aircraft had come open. Moments later the door came off and went up and over the radome and into the left engine intake. The pilot got the bird down right away. Although there was only slight skin damage, a latching pin was ingested by the engine, which required an overhaul.

No sign of materiel failure appeared so it was assumed that the door was not properly locked. The aircraft had been preflighted several hours prior to takeoff, then was serviced through the access door by a different maintenance man who could not recall latching the door. The pilot's walk-around was at night with a flashlight and he apparently did not see that the door was not latched. The crew chief did not accompany the pilot on his walk-around.

As a result of this mishap, the unit took the following steps:

- When a door forward of the air intakes has been opened for maintenance or servicing, an entry will be made in the aircraft forms and the bird will be placed on a red cross. This *must* be signed off by a qualified maintenance supervisor after he has inspected the doors.
- The crew chief will accompany the pilot on all walk-around inspections. ★



taping the accident

The C-133 Cargomaster joined the Air Force inventory some eight years ago. Since then, there have been several major accidents — four of which occurred over water with little or no wreckage found. The causes are still undetermined.

As a result of these accidents, the Air Force grounded the C-133 fleet and began an exhaustive research program to evaluate the flight characteristics of the aircraft and performance of its systems. Another action was the decision to install a flight recorder.

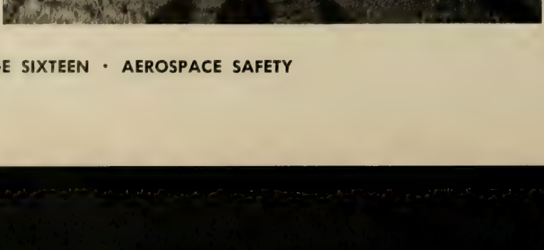
The system selected was the Lockheed Ejectable Flight Recording System (LERS), which measures and records some 89 parameters. The recorder is contained in a package mounted in the tail cone and is designed to survive a crash on land or water.

For years Lockheed has built and supplied flight recorders for the airlines. However, these record only four parameters, valuable in the investigation of several airline accidents, but not suitable to the needs of the Air Force. They had also been experimenting with more sophisticated units aboard a TWA 707 and an Air Force B-52, so when the Air Force went shopping for a recorder system, the company was ready.

USAF specifications required measurement of a large number of items and retention of aircraft and system performance for a specified time. The unit, as installed, provides a continuous recording of data with the last 15 hours always on tape. A four-channel voice recorder always contains 30 minutes of conversation.

Another USAF requirement was that the recorder be recoverable and that it contain a beacon to guide searchers to the scene of an

Flight recorder could be the key to solving accidents such as this.



accident. Various methods were investigated, with the final configuration providing an ejectable unit (crash position indicator — CPI) that would stay with the aircraft in a crash on land but be ejected in the event of a water crash. Water pressure activates hydrostatic switches that start a gas generator which ejects the recorder-beacon package. The pilot has a switch with which he can eject the package at any time. The equipment is designed to withstand fire and shock during a land accident.

The system works essentially as follows: Transducers monitor the required items, e.g., acceleration, position of flight controls, indicated airspeed — 89 in all, and feed signals to a signal converter and multiplexing unit. This unit converts and multiplexes the output into six composite signals representing 45 data points sampled once every three seconds.

A data recorder electronics unit accepts the multiplexed signals and converts them to frequency modulated outputs acceptable to the recorder.

The recorder contains a tape cassette with 900 feet of mylar magnetic tape. Half the tape width is used while running in each direction and provides a 15 hour recording. The smaller voice recorder uses a continuous loop of one-quarter inch tape.

Units are being installed in all C-133's by Lockheed teams at Travis and Dover AFB's. Lockheed engineers will maintain the recorder system in the field and provide tape readout and analysis service.

While the LERS was bought primarily for accident investigation, the future of data recording systems for other purposes looks bright. At a Flight Recorder Conference last August, representatives from nearly every command discussed Air Force requirements for flight data recording systems. Five commands had submitted QOR's (Qualitative Operational Requirements) for such systems, although their requirements varied considerably. Essentially, the needs ranged from relatively simple recorders to more complex systems requiring base-level computers.

Conclusions reached were, briefly:

- A survivable flight data recorder (FDR) was needed immediately on certain aircraft for accident analysis purposes.
- An expanded system in the future could provide data to be used in daily operations to improve maintainance and operations.

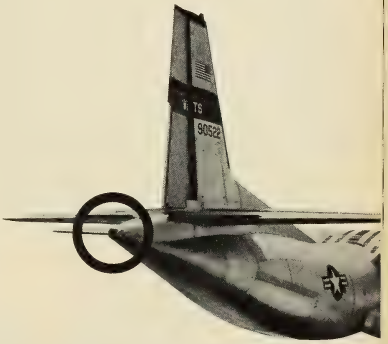
Future uses to which FDR's can be put might be diagnosis and analysis of trends affecting engine and other systems' performance. Failures can be anticipated and repairs accomplished at some predetermined point in time.

Other uses can be foreseen; for example, the information could be produced on punched tape to be fed directly into a computer or telemetered from the aircraft to ground stations for quick repair and turnaround at the next point of landing. The concept could be carried farther, e.g., the ordering of spares and for inventory purposes and automatic resupply. Or, an expanded system could provide readouts on the engineer's panel for inflight diagnosis and possible correction of malfunctions.

This, however, is speculation about possibilities for the future. Present hardware installed in the C-133 is designed to:

- Measure performance of 89 different items.
- Record this information continuously, with the last 15 hours of the record always on the tape along with the last 30 minutes of voice conversation on the voice tape.
- Eject when an aircraft crashes in the water and broadcast for a minimum of 48 hours on guard channel.
- Remain with the aircraft during an accident on land for retrieval by accident investigators.

We hope, of course, that this system will never be put to test in a C-133 accident. But it is good to know that, should a disastrous accident occur, there will be something that will point to the cause, or at least provide the necessary clues to determine the cause. We think that the LERS, and similar systems, have a tremendous future and that these capabilities should be exploited to the utmost, not only in accident investigation and prevention, but in improved maintenance and supply and, consequently, higher operational efficiency. ★



Tail installation of ejectable flight recorder is shown in these photos.

your money's worth

Capt Robert K. Strickland,
317 Fighter Interceptor Squadron,
APO Seattle 98742

The runway was wet but the braking action was good and the heavy fighter easily responded to brakes and drag chute. As the speed slowed, I cautiously engaged nosewheel steering and guided the bird off the runway. The low hanging clouds hid the nearby mountains and a light mist frosted the canopy. I had every reason to feel a sense of accomplishment. I had just successfully handled an airborne emergency in a century series fighter at its most vulnerable moment – takeoff – and under marginal weather conditions. The ultimate criteria of both bird and pilot down safely had been met and now I could adjourn to operations to spin my latest war story.

As the adrenalin began to subside, a feeling of displeasure crept forward, however, and I couldn't deny it. I had felt it at various times before but now it hung on in spite of my efforts to shake it.

To the layman, there is a difference between a job done to meet standards and one that is completed with competence and skill. With the addition of experience, the job can be outstanding. Only at this point should the performer call himself a true professional. I felt I had reached this zenith, yet I felt a definite sense of inadequacy. I had accomplished the mission – but professionally? To enlighten you, let me recap my experience.

It all began with an early morning air defense exercise. Planes were assigned and I set up for a five-minute response. Since there were several pairs of fighters and staggered target times there was some delay between scrambles. I was Nr 2 in the second flight to go. This is where my problems began.

When my flight was scrambled, I dashed out to the bird and jumped in. The crew chief was there with helping hands but nothing went right. The harness was twisted and a parachute strap got hung under the seat. These nuisances delayed me some and the start was slower than normal. For some reason the carefully memorized scramble checklist deserted me at that moment and I fumbled my way around the cockpit in quiet desperation, fervently hoping to cover at least the most important items. Finally it seemed I was ready, but by now my leader was well ahead of me and again I found myself behind – this time literally.

Fortunately there was an ATC hold on the runway and I was able to catch up. The weather was none too pure – 400 feet broken with one mile in rain and snow – and the added traffic for the exercise backed up the control problem a bit. At this point, I went to the written checklist for a final check and all looked good. I even had a few spare moments to give the radar set a brief check and fine tune. The tower cleared us to departure control finally and Nr 1 rolled almost immediately. By now I was checking my engine gages and when the leader rotated, I released brakes.

My afterburner lit with a comforting push and the gages all showed green. As soon as I rotated, I started cross checking the flight instruments. When I was definitely airborne I flipped the gear handle up and concentrated on the flight instruments. The gear horn and light came on with annoying speed and I called departure control. By this time I was well into the weather and noted the ice that suddenly developed on the wind screen. Airspeed was beginning to build satisfactorily but the gear horn kept up its unholy racket. Just my luck, I thought, as I came out of burner and popped the boards, now I've trapped the gear. As the airspeed diminished, I leveled off and started feeding in trim; at the same time I cycled the gear. No trouble getting three down but something definitely wasn't coming up. The emergency up system didn't help any nor did the ice that was rapidly collecting on the windscreen.

I was faced with two choices. I could stay out of the way until everyone else got off, then land, or I could turn around right then and go home, landing before the next flight was scrambled. Visions of ice inches thick caked to whatever I had hanging influenced my choice. I asked departure control for a vector to the final approach course and explained my problem. Precise instructions came immediately in a confident professional voice. Since my first problem was solved — what to do? — I now had another: landing this bird at near maximum gross weight under marginal weather conditions. Such a landing presents no real problem, but it does require precise flying.

The directions from approach control were accurate and timely. Unfortunately, my flying didn't respond in kind. I had plenty of excuses. The trim was slow, the gear was down, the heading indicator was off, *ad infinitum.* Actually what it boiled down to was me. I let the aircraft slop around under the excuse that when the time came to be precise I would really get serious and peg those needles. I wasn't off much, but I wasn't on much either. I didn't take the trouble to really concentrate and get everything fully under control. Precise control was not an absolute necessity, but it would give me a definite advantage.

After I turned on the ILS final, I did get serious and pegged the needles and everything turned out okay, as I related earlier. The problem though wasn't really solved, it was just temporarily by-passed. I had allowed human frailty to overcome professional performance. I was relying on experience to bring me through a situation that required not only experience but skill, which incidentally aren't synonymous here. Would a second emergency have exceeded my experience level? Could I have handled the two as successfully? I've been in the fighter business for many years and I have about 2000 hours of single engine jet time in my Form 5. Even so, that does not allow me the luxury of complacency in any flying situation, whether it be a full blown emergency or a routine cross country flight.

It is human nature to overlook small errors especially when we know we aren't being evaluated. This attitude must be overcome if we are to call ourselves professionals. We in the Air Force who fly must regard ourselves as the finest group of professional pilots in the world, then stand ready to prove it at a moment's notice. It is part of the heritage of the USAF and one needs only to read a daily newspaper to realize the "moment's notice" has already come for many of our contemporaries. All the IP's and FE's in the Air Force cannot improve the breed one bit, if the desire and devotion don't come from within.

Those of us in single seat aircraft who fly everyday have less than constant individual supervision. The responsibility lies with the individual to constantly evaluate and criticize his own performance. We know when we've done a good job. We also know when we haven't done so well. Fortunately, these times rarely come to the public eye, but WE know and that should be reason enough for improvement. A few extra minutes in the Dash One every day and a little more attention to detail in the simulator will pay large dividends later. Those low level sightseeing tours could be much more valuable if they were spent in the GCA pattern. Don't be satisfied with an average approach. Try to make each one outstanding.

There are many diversionary activities in the life of an Air Force pilot today. These same diversions are available to professional people in other fields. However, I would like to feel that, should I need the services of a professional artisan, he would be able to provide more than just an *average* performance. It's like "wanting your money's worth," be it services or goods. This same criterion we should apply to our flying. Whether we have chosen the military for a career or an interim job, we owe it to ourselves and to our country to do the best job possible. Besides, flying is one of the very few professions where one's first mistake is likely to be his last.

The next time you fly, take a critical look at your performance. Is your climb speed right on the money? or do you let it vary with the thought "who knows or cares?" Are you maintaining assigned altitude or just flying VFR on top? Did you set your altimeter to 29.92 at the right altitude or wait 'til you leveled off? How were your voice procedures? AFR 60-16 has some very specific guidelines for certain situations. Do you abide by them, or just slop through with a few "ah's" and a "Roger" or two? Have you practiced an SFO recently? How about your formation? Do you fly the standardized position or do you have your own? Ever discussed it with Stand Board? How was your last penetration?

If you were a flight examiner, how would you rate the performance of the last man you flew with — either in a two seater or on his wing? How would you rate *your* last flight? As a professional pilot, would that rating suit you? ★

WILLIAM

Competing aircraft on ramp at
Tyndall AFB. Ground crewman races
to prepare his aircraft for a mission.
Loading specialist checking Falcon missle.

TELL 1965

Lt Col John M. Vargo,
73 Air Div (ADC), Tyndall AFB, Fla.

All the ingredients for a safety officer's nightmare were present during the 1965 U.S. Air Force Fighter Interceptor Weapons Meet last October at Tyndall AFB, Fla., but, in the final analysis, it was the biggest and safest of all William Tell events.

There were no accidents — in the air or on the ground.

Rough weather, accelerated flying missions, extensive missile-armament loading operations, rescheduled sorties and cliff-hanging suspense were some of the ingredients which faced both aircrew and ground crew members. There were more missiles and armanent fired during this eight-day meet than by all of the rest of the combined Air Defense Command during the same period.

Torrential downpours, line squalls, strong crosswinds and low ceilings added realism and IFR conditions to the supersonic sharpshooters. Florida's typical weather was temporarily invaded by a near hurricane tropical storm. Squalls, thunder and lightning, plus unpredictable gusty surface winds tested the tactical effectiveness of our all-weather fighter interceptors, aircrews and ground support teams.

Safety-conscious officials, with a keen eye on the capricious Gulf Coast weather, were finally forced to scrub some sorties, thus jamming rescheduling requirements for make-up missions. When the sun finally broke through with VFR conditions, it was an accelerated "GO" in continuation of competition firing. Fortunately, nobody was caught with his canopy down, thanks to on-target forecasting by Detachment 5, 32d Weather Squadron at Tyndall. They pinpointed the storms before the meet opened, accurately plotted their movements and were able to correctly predict the outcome. This enabled the "decision makers" to make sound decisions — a hurricane evacuation at this time would have involved hundreds of aircraft and would necessarily have delayed or forced a postponement of the meet.

As with all William Tell activities, advance safety planning began many months before the meet officially opened on October 1. Every potential safety problem area was probed, scrutinized, dry-run and closely monitored during actual operations. In addition, four missile experts from within the Air Defense Command augmented the Tyndall AFB safety staff in monitoring overall activities in this major operation.

Pivotal area for safety functions was the 4756 Air Defense Wing's office of the Chief of Safety under Captain Bobby G. Huggins. Ground safety — a key factor in the success of any program — was directed by Mr. Leo G. Miller, also with the Tyndall safety office. Captain Huggins enjoyed a participant's role, as well as a safety officer's, when he piloted several F-102 photo missions with cameramen from a television network.

During this meet the word "safety" was considered a misnomer. In itself it would hardly express the scope of the Air Defense Command's accident prevention effort. Primary concern was not safety for safety's sake, but the acceleration of mission accomplishment through increased operational effectiveness. Safety was the keynote; however, it was implanted as a nonidentifiable factor in the preparation of this meet. It literally was a product and integral part of an efficiently planned, supported and executed mission.

Safeguards were designed into the competition rules. For example, exacting performance became mandatory before the Range Safety Officer would clear an interceptor to fire, judges assessed penalties against ground crews who compromised ground safety procedure during loading, and chase aircraft monitored in-flight phases of intercepts.

How successful were we? Well, this is difficult to answer. To properly evaluate the overall effectiveness of a safety program requires an innate understanding of the principles of safety management and objectives. How successful is, to some degree, a difficult task to measure because there are no cut and dried criteria, yardsticks or formulae for evaluating specific, objective-type achievements in safety. This is necessarily so because it deals principally with an intangible product — the accident that did *not* happen. The fact is we didn't have a single accident. Who can argue with success?

First place in the F-102 category was captured by the 32d Fighter Interceptor Squadron (FIS) from Camp New Amsterdam, The Neth-

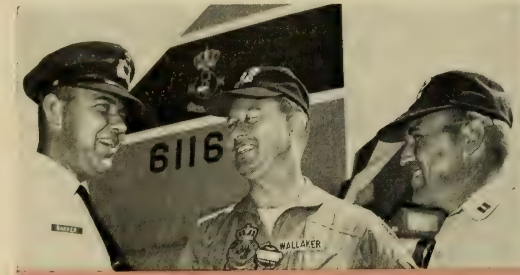
WILLIAM TELL continued

erlands. Its victory over the 59th FIS of Goose Bay, Labrador, ended a brilliant duel when the final winner crossed the wire just in front of his competitor. Final score showed 8782 of a possible 11,000 for the 32d – 642 ahead of the 59th runners-up.

The victory was especially sweet for the 32d representing the United States Air Force in Europe. It was the first time the unit has ever competed here and also marked the first time that foreign aircraft controllers were part of a winning effort in the biennial event. A team of five Royal Netherlands Air Force ground control intercept specialists directed the 32d pilots to their targets.

An even closer scramble was settled late Thursday when the 71st FIS of Selfridge AFB, Mich. stormed back to take first place in the F-106 Delta Dart category. The Wolverine State pilots added 850 points to squeeze past the 5th FIS from Minot AFB, N.D. by just 130 points.

From a possible 11,900 points, the 71st finished with 8,612 while the North Dakota unit ended with 8482.



A "first" was set when foreign controllers directed USAF interceptors.

Winning team captains with Lt Gen Thatcher, ADC Commander.

The 331st FIS from Webb AFB, Tex., entered the winner's circle in the F-104 Starfighter category with a final tally of 7342 points. The Texans finished competitive action with a 1090 lead over the 319th FIS of Homestead AFB, Fla.

The F-104's were shooting for a possible 10,500 points. Both units ended action with heavy flying schedules which added 825 points to the Floridians' total. But, that wasn't enough as the Texans did some fancy shooting of their own to grab 650 final and deciding points.

Competition in the F-101 Voodoo category ended with cliff-hanging suspense and the narrowest margin of victory. The 62d FIS, K.I. Sawyer AFB, Mich., edged past the 13th FIS, Glasgow AFB, Mont., by 115 points when the Michigan unit splurged for 1290 points in their final missions.

Their brilliant last-ditch effort was necessary to dislodge the Montana pilots who grabbed 1175 in their curtain-lowering operations. Final scores for both units, who were competing for a possible 12,400 points, showed 9198 for the 62d FIS and 9083 for the 13th FIS.

Brigadier General Thomas H. Beeson, Commander of the 73d Air Division and host for the '65 event, said, "There were no losers in this worldwide fighter interceptor weapons meet. They came here from across the nation, Canada and Europe to test men and machines under grueling conditions as realistic to war as possible. They did just that and in doing so with a flawless safety performance, once again demonstrated to the people of North America that its air defense mission is in good hands . . . each man participating in this giant Air Defense Command operation has my gratitude for making it the biggest, best, and above all – the safest fighter interceptor weapons meet on record." ★

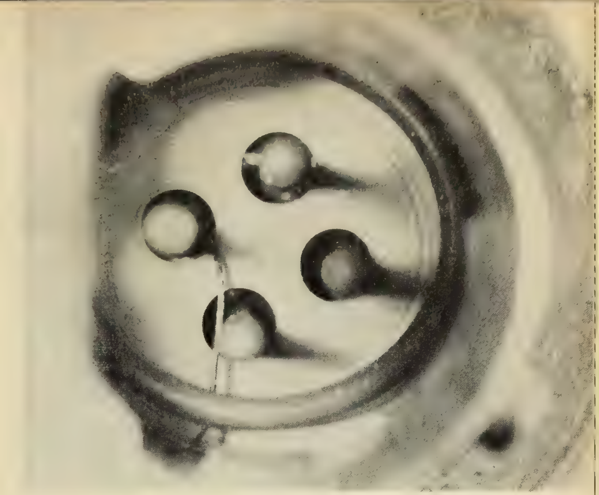


Figure 1

Ready? Safe?

Lee Watts, Systems Engineer

Strategic Systems, Martin Co—Denver Div

Is the integrity of your missile flight critical circuits intact? Will all systems perform as programmed? Are you SAFE from inadvertent ordnance firing? The answer to these questions is very likely, "yes IF all the missile electrical connectors are clean and free of contamination."

Missile weapon systems have experienced malfunctions directly attributable to metallic contamination within electrical connectors, which indicate improper inspection and/or inadequate cleaning procedures. Periodic checkouts will detect nearly all modes of failure of missile circuits; however, certain faults can go undetected. These faults result in flight failure or inadvertent firing of missile ordnance.

Ordnance connectors are particularly susceptible to contamination due to their small size and design. Small metallic particles, 0.025" or greater, can short a pin to a case that is at missile skin or facility ground potential. The photograph above (Fig. 1) shows a pressure cartridge connector contaminated by a length of bare wire. This wire provided the fault current path which fired a pressure cartridge resulting in a hazardous situation as well as considerable out of readiness time. Emphasis on better inspection controls and practices would have prevented this problem.

Figure 2 schematically illustrates how a typical ordnance circuit is susceptible to connector contamination. A parallel DC return path is established by the contamination through the faulted ordnance item. This path is indicated in Figure 2 by the heavy arrows. If the resistance ratio between the normal return path and the parallel path produced by the fault is low, or if the DC current is large, the current through the faulted ordnance branch can be in excess of the five ampere sure fire rating. DC faults to ground, in-rush current during start of missile hydraulic motor pumps or the charging of large airborne capacitors (as shown) can provide surge currents of sufficient magnitude to fire a faulted ordnance item. Figure 2 also shows how contamination can shunt a bridge wire preventing its ignition.

A high percentage of ordnance devices short to case when fired. If a device does short to case when fired and another device exists within the system with a fault to ground, it will be prematurely ignited resulting in possible flight failure. Figure 3 schematically displays how this can occur.

In conclusion, there exists a definite need for complete and thorough inspections of all missile electrical connectors if the required safety and reliability are to be achieved.

In the Titan II Weapon System a modification will isolate the ordnance return circuits during readiness. This change also incorporates a sensor for the detection of electrical shorts within ordnance connectors. While this modification provides safety in readiness and assurance of the integrity of the ordnance circuits prior to flight, it in no way eliminates the need for thorough inspections of all electrical connectors prior to mating.

Similar problems of contaminated non-ordnance electrical connectors could result in serious flight problems and have actually caused aborted missions in missile test programs. Flight control and guidance circuits are especially susceptible to these modes of failure. ★

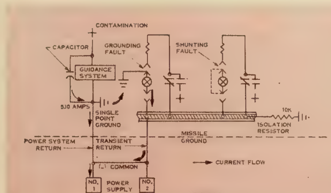


FIGURE 2

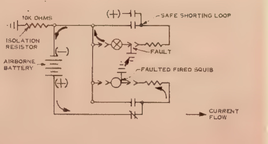


FIGURE 3

Missilanea

CIM-10—A missile periodic had just been completed at a CIM-10 (BOMARC) squadron with no abnormal indications. In a post inspection check, the right aileron was found damaged. The culprit responsible for the damage appeared to be a movable temperature control stand. Apparently, during preparation for the inspection, the stand had been inadvertently placed under the leading edge of the aileron. The unit is implementing a more thorough walk-around prior to each power application and is also recommending shortening of the movable stand to prevent aileron/stand contact.

INNOCENT BYSTANDER INJURED — "Dateline Blank AFB USA. — This morning an innocent bystander was struck by an Air Force water tanker that was backing up for a servicing operation. Witnesses stated apparently no one was directing or supervising the operation. Injuries consisted of . . ."

In this instance, the innocent bystander was a Hound Dog missile and the Air Force water tanker was a unit being backed in preparation for servicing a B-52. The lack of a directing supervisor or spotter has caused this incident to fall in the supervisory personnel error category which accounts for 60 per cent of the Hound Dog mishaps. It points up the requirement for the constant and continuing emphasis on supervision and control of ground handling and servicing equipment that must be a part of every unit's safety program.

Capt R. A. Boese
Directorate of Aerospace Safety

HOUND DOG ENGINE FIRE — After completing the Before Leaving Aircraft Check List, the pilot of a B-52 was notified by the ground crew that the left AGM-28 was still running. The missile switches were checked in the OFF position and the EGT and RPM on both missiles read zero. Leaning out the side window and observing that the Hound Dog was still running at a high RPM, the pilot actuated the emergency shutoff switch for the Nr. 1-AGM. Engine shutdown occurred and fire broke out in the missile engine. It was undetermined whether the engine caught fire jus prior to, during or after the pilot actuated the emergency shut-off switch.

The aircraft recovery crew contained the fire unti arrival of the fire department. Damage consisted of major fire damage to the missile engine and minor damage to paint.

After the AGM was removed from the aircraft, investigators started trying to find the cause of the fire.

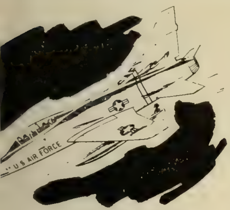
The missile emergency fuel shut-off valve was found in the open position and the aircraft emergency shut-off switch was in the normal position. If the emergency shut-off switch had been actuated to CLOSE momentarily and then placed back in the normal position, the engine would have flamed out. Fuel would have pooled in the engine and engine fire would have resulted. However, since the pilot is certain that he left the emergency shut-off switch in the shut-off position and since it is also possible that a malfunctioning fuel control system could have caused an identical situation, no positive conclusion can be drawn from this as to the cause of fire.

Investigation revealed that the power lever actuator would not move below the 65-degree position. A defective feedback potentiometer in the actuator was the culprit. TCTO 21M-AGM28A-610, which requires replacement of the throttle control amplifier with an improved amplifier, had not been complied with.

It is recommended that, if AGM engines do not shut off normally in flight, the flight crew request maintenance assistance to manually shut down the missile after landing. ★

Maj Edward D. Jenkins
Directorate of Aerospace Safety

Aerobits



MISSING PANEL. The aircraft was Nr 3 of a four ship flight of F-100's on the bombing range. During turn to initial, the pilot thought he felt a birdstrike. Nr 4 looked him over and noted a missing panel (ground hydraulic quick disconnect). The pilot then terminated and returned to base for an uneventful landing.

On the ground it was determined that, during a very busy period just before launch, rain had fallen and several panels were temporarily secured. Unfortunately, the panel that left the aircraft had been secured with only two fasteners. During inspection of the aircraft six people, including the pilot, failed to notice the loose panel.

RUNWAY — WHAT RUNWAY? Of the F-105 accidents in 1965, one-third have occurred during landings and takeoffs. The only item in common with the three overrun/approach light landings we have had is the low visibility in light rain and fog. Specifically: Nr 1 happened in the afternoon with 2½ miles in light rain, Nr 2 at dusk with 4 miles in light rain, and Nr 3 at night with ¾ miles in fog and rain.

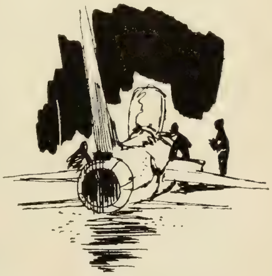
There is no new solution to this problem. The same old story still applies, take the GCA controller's instructions, cross check, and use the runway as another available instrument. The Dash One also still says:

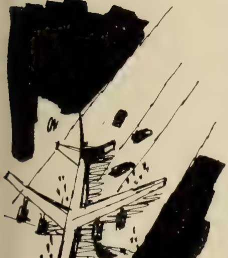
(1) Touchdown at recommended speed.

(2) Throttle — IDLE.

Reversing steps (2) and (1) will eventually assure a "desert" landing and a "desert" landing in an aircraft this heavy generally does major damage.

Major P. R. O'Brien, Jr.
Directorate of Aerospace Safety





SLICK RUNWAY. Two miles from touchdown the B-52 pilot undoubtedly thought that this landing would be a piece of cake. Then everything turned sour.

What happened?

Weather reported a measured 1400 feet overcast with five miles vis, light freezing rain. At two miles out the pilot was given an RCR of 24. At about this time the weather observer noticed the beginning of ice formation but did not think that this would be serious before the landing could be completed. The aircraft touched down 2000 feet from the approach end, but the runway was by now so slick the pilot felt that his brakes had failed. His brakes hadn't, but his brake chute had and the aircraft went off the end of the runway.

When the chute was installed a piece of the main canopy was jammed under the door of the chute compartment, which prevented the door from opening. Winter is no time for malfunctioning drag chutes. The weather changes rapidly and what may look good one moment may be terrible the next. Then a malfunctioning chute might mean the difference between a successful landing and an accident.

Aerobits

A-SLIPPIN' AND A-SLIDIN' — Ol' Man Winter is back in business and this means snow and ice on the taxiways and runways.

The B-52 is difficult, if not impossible, to control when skidding on ice. Some of our troops stationed at northern bases will attest to this. Here is just one of the many incident/accidents that occurred last winter (and there's always that possibility of a recurrence).

The crew had just completed three taxi-back landings and was preparing for another takeoff. The aircraft was cleared and started the takeoff roll. In the process of turning onto the runway, the pilot overshot the centerline and was advised by the IP to tighten the turn and get in the center of the runway. The IP then got on the controls with the pilot and discovered that he had no steering authority. The IP attempted to regain control by using a combination of brakes and steering, but the aircraft continued to slide toward a snowbank on the other side of the runway. It was apparent to the IP that he could not stop the aircraft so he shut down all engines except Nr 3, and set the brakes. The B-52 continued "a-slippin' and a-sliding'," and finally came to a stop in the snowbank. Fortunately, damage was minor.

Some of our northern bases must live with the problems of thawing and refreezing, which result in patches of clear ice on taxiways, runways and ramps. So, be alert, cautious, and use extreme care, especially during nighttime operations. Don't go "a-slippin' and a-slidin' " in the B-52. It isn't healthy!

Lt Col Harold E. Brandon
Directorate of Aerospace Safety

NUTS & BOLTS. Here are a couple of **incident** reports that could very well have been **accident** reports. The story behind each of these is an old one: garbage in the controls.

RF-101 — During turn from base to final, the pilot noticed the control stick freeze momentarily in the lateral axis. When he applied more pressure, the stick yielded somewhat and he was able to line up with the runway and make an approach and landing. After the aircraft was on the ground the control stick could not be moved to the left. Throughout the event the hydraulic pressure remained normal. Inspection turned up a couple of screws, one lodged between the bell crank aileron torque tube and adjacent bulkhead, and the other in the bottom of the compartment. The aircraft had been released from periodic inspection the day before.

F-100F — The aircraft was flying righ wing on a formation takeoff. After gea and flaps retracted at approximatel 250KIAS, the aircraft seemed to want t roll to the right. Rudder kept it fron rolling, but when the pilot attempted t turn right to move out from Lead, th control stick would not move to th right. Hydraulic pressure was normal Meanwhile left rudder was required t keep from rolling to the right. Finally the pilot used both hands and forced th stick from left to right. He heard an felt a thump as the stick broke loose Normal control response then returned Sure 'nuff, there was a bolt with nut an washer caught between the bottom o the arm assembly and the bottom insid of the control stick support assembly Apparently the bolt was left in the aircraft during IRAN, since no maintenanc had been performed on this area sinc IRAN.

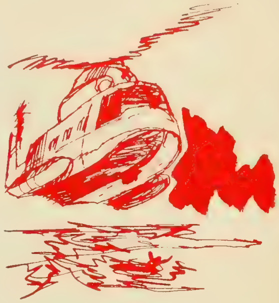
NEW CHOPPER FOR VIET NAM. The Air Rescue Service has taken delivery on their first HH-3C—a twin engined, 5 bladed, cargo type chopper, modified especially for Viet Nam rescue operations.

Bulletproof panels will furnish increased protection for crewmembers and vital aircraft components. Because of the need for extended range rescue operations, auxiliary fuel tanks normally carried by the F-100 fighter were fitted outboard on sponsons of the HH-3C. An FM radio will permit the helicopter pilot to talk directly to ground tactical controllers rather than having to communicate through tower communications systems. Special direction-finding equipment gives the helicopter crew the ability to "home in" on a radio beacon carried by crewmen of fighters or bombers who have been shot down. The extra power provided by General Electric T58-5 engines maintains the performance of the -3C helicopter despite addition of the extra weight of the armor plating and other equipment.

The CH-3C is normally equipped with a combination cargo loading system and rescue hoist which extends from the cabin. This has been augmented by an external hoist with more than double the length of cable which is installed above the cabin door to give the helicopter crewman better control, thus expediting the rescue operation.

Modification of the helicopter improves the Air Force's ability to locate and pick up men who have been shot down in jungle or behind enemy lines. The HH-3C has been designed not only to increase chances of returning downed airmen but to give necessary protection to its own crew during operations over unfriendly territory.

Lt Col Robert E. Englebretson
Directorate of Aerospace Safety



SAME SONG — MAGNESIUM WHEELS. Takeoff roll was normal until, at approximately 100 knots, a slight thumping noise was heard in the cockpit. The takeoff was continued and after the C-130 became airborne, the loadmaster reported there had been a severe thumping or buffeting sound coming from one of the main landing gear areas. Gear retraction was normal and all indications were satisfactory. In an effort to pinpoint the problem, the aircraft was depressurized and inspection plates removed to check the gear. Inspection revealed the rear wheel of the left main gear had been damaged. Due to aircraft weight, parts availability, weather and mission dictates, a decision was made to continue to the destination.

Upon arrival, another airborne inspection was made, and it was determined the wheel would not rotate. The runway was foamed and an uneventful landing was accomplished. After the crew evacuated the aircraft, a maintenance tug was attached to tow the C-130 to the maintenance area. As the aircraft was being towed, metal chunks and particles began falling from the left gear area and a grinding noise was heard. Towing was terminated and a new wheel and brake assembly installed. A 39-inch long break, up to one and one-half inches wide, was found in the wheel assembly. This break had in turn created pressure on the brake assembly preventing free rotation of the wheel. The manner in which the aircrew handled this malfunction and the landing on a foamed runway prevented a more serious accident that could have been caused by heat generated from the jammed wheel and brake assembly.

NOTE: The above incident is attributed to materiel failure of the magnesium wheel. Concentrated efforts are now in motion to replace all C-130 magnesium wheels with aluminum wheels by February. Until that time, insure compliance with existing inspection directives until we are 100 per cent complete with the aluminum retrofit.

Maj William M. Bailey, Jr
Directorate of Aerospace Safety

Aerobits

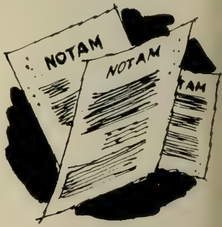
KNOW YOUR AIRPLANE TODAY. (F-86F). The pilot, just completing a satisfactory flight, taxied to the line and parked the airplane. He moved the canopy switch to the OPEN position but the canopy opened only about six inches and stopped. The pilot planned to declutch the canopy and manually pull it aft. However, instead of pulling the declutch handle, he pulled the canopy alternate emergency jettison handle and blew off the canopy. (Fortunately, his forward position prevented his head being hit by the canopy bow as it moved aft.)

The pilot stated that he knew where the declutch handle was located in this airplane, but that he inadvertently pulled the wrong handle because his recent training had been in an airplane in which the declutch handle was located in the same relative position as the canopy jetitison handle in the "F."

Cockpit controls are shaped and placed to minimize improper actuation. But cockpit controls can vary in their relative positions in different types, and even in the same types among different blocks of airplanes. No injuries resulted from this occurrence, but it does point up the need for knowing the location and function of every control (especially emergency controls) on the airplane you are flying today, not the one you flew yesterday.

No Am Avn Operation and Service New

Central NOTAM—The Air Force and FAA took the first step toward a single National NOTAM System when the USAF/USN Central NOTAM Facility (CNF) started moving from Tinker AFB to the FAA Hq in Washington, D. C. Both systems will function as separate units pending consolidation into a single National NOTAM System. When that will be will depend on availability of adequate telecommunications and computer services. ★



FALLOUT

continued from inside front cover

and reached the same conclusions as ours; (3) AFCS at Scott AFB has some research underway in this area; (4) Fighter pilots don't like VASI as a VFR approach aid, and (5) Something has to be done about all of this, soon.

Our views run like this: Present siting criteria are obsolete. Placement must be based on a comparison of runway available versus aircraft characteristics. VASI must be disassociated from IFR aids. Pilots can and do accept a high glide path IFR, knowing that they must correct at breakout. In a VFR approach, however, they know where they want to be, and it's always lower than present VASI approach slopes. It is nonsense to require a pilot to fly a precision glide path that is less than optimum when he is VFR.

We can promise more on this subject in the near future.

WE GOOFED

Have just received the November issue of AEROSPACE SAFETY. I think this is a very good method of keeping the troops informed, have nothing but praise for the staff and all the other people who make this magazine possible.

BUT! This time, somebody goofed. The goof in question is on page 3, and the picture should be titled "What's wrong with this picture?" Here are a couple of things I see wrong, if I am not wrong:

1. Oxygen servicing cart too close to aircraft being serviced with fuel.
2. Fire bottle access obstructed by tool box, and other safety hazard items. These are but a few of the things one sees at first glance.

This picture could very easily be misleading to a new troop. It could lead him to believe his supervisor is all wet when he tells him that oxygen safety is very important and must be handled with care that all the rules about distances stated in Tech Orders and good housekeeping are paramount to good maintenance.

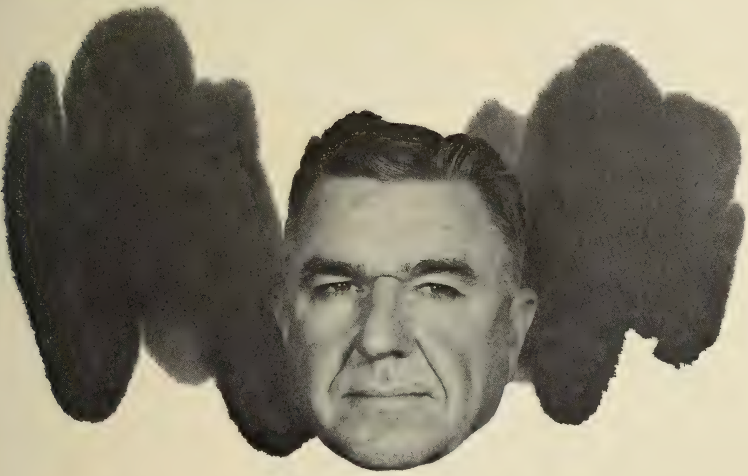
That's about it. Keep up the good work.

TSgt Sam G. D'Ortona
Aircraft Tech Advisor
Hq Sq M/MS 10 TRW
RAF Alconbury, Englan

You're so right. We did goof, but discovered the discrepancy too late to do anything about it. We've been waiting for letters; so far, yours is the first. Thanks fo writing.

☆ U.S. GOVERNMENT PRINTING OFFICE 1966 201-213/

WELL DONE



MAJOR THOMAS E. NEWTON

50TH TROOP CARRIER SQUADRON, SEWART AFB, TENN

On 12 August, 1964, Major Thomas E. Newton was aircraft commander of a C-130E aircraft enroute from Sewart AFB to England AFB, Louisiana. During the inflight landing check, the main landing gear indicated down and locked, but the nose gear indicated "in transit." All published emergency procedures were followed in an attempt to get the nose gear down and all were without success. The pilot then decided to return the aircraft, main gear down and nose gear in transit, to Sewart AFB where technical assistance and maintenance could be more readily attained.

Upon return to Sewart AFB, Major Newton orbited the area and attempted several maneuvers to force the nose gear into a locked position. All were unsuccessful. A decision was then made to chop a hole through bulkhead station 165 and to loosen the bleed plug on the nose landing gear actuating cylinder one and one-half turns. This allowed hydraulic pressure applied to the cylinder to escape and the gear to move slowly to the down position.

After these actions were completed, the pilot applied positive "G" to the aircraft and the nose gear indicated down and locked. As an added safety measure, the nose gear was chained down and a normal landing was accomplished with no further damage to the aircraft.

This incident is the first of its kind to occur with the C-130E aircraft. Major Newton's knowledge of the aircraft hydraulic systems in general and of the landing gear in particular prevented possible injury to the crew and extensive damage to this valuable aircraft. WELL DONE! ☆

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FALLOUT

WHERE THE ACCIDENT BEGINS

"Where the Accident Begins" (in the November issue), was a timely article on a promising procedure which I believe will soon become standard at least for Century Series aircraft. However, your artwork was in error in that it depicted the GCA unit as sited adjacent to GPIP. In fact the GCA or precision component is sited not less than 2201 feet farther down the runway from GPIP. Your artist should have drawn a radar reflector at GPIPs instead of the GCA shack.

I highly recommend that you obtain a copy of "Report of Operational Evaluation of Relocated Glide Path Intercept Point," 1st CEG, Barksdale AFB, La. This comprehensive report evaluates the findings of AFCS, 2AF and 1st CEG, following B-58 testing of the methods described in your article. The test took place from 16-20 August 1965 at Little Rock AFB, Ark.

Capt Clyde M. Slade
AFCS, Tinker AFB, Okla

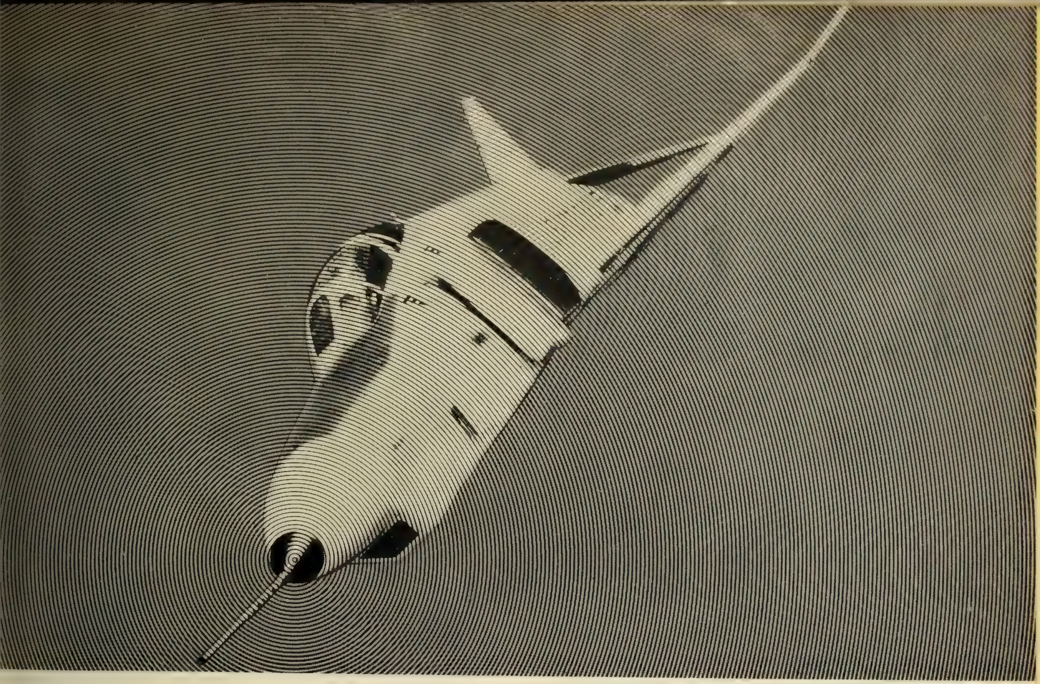
We are aware of the tests you mention. Thanks. As for the GCA shack—artistic license.

HURRICANE HUNTERS

The drama of a handful of men pitting their aircraft and skill against the fury of a hurricane and penetrating its eye to learn its secrets has been the subject of radio and television programs, movies, books, magazine features and thousands of new articles.

Since 1946, that's what the "Hurricane Hunters" of the 53 Weather Reconnaissance Squadron have been doing—providing the Armed Forces and the U.S. Weather Bureau with around-the-clock hurricane warning information, along with their other weather gathering missions.

Last November 30 marked two decades of storm reconnaissance for the USAF Hurricane Hunters. During the 20 years the squadron used six different types of aircraft in flying thousands of hours without a major aircraft accident during these flights. Many flight crews, maintenance and support people made this record possible. We salute them.



Spins

By Captain Don Engen, USN

Reprinted from
APPROACH Magazine, April 1959

Pilots have been spinning airplanes since shortly after Orville Wright first took to the blue at Kitty Hawk. Prior to about 1916, the spin usually ended fatally. This was primarily because the recovery controls required were unnatural to what the pilot felt was required. He was diving toward the ground and back stick was all that he knew would prevent his descent.

Around 1916 it was discovered that forward stick and opposite rudder were effective for recovery and spin fatalities decreased. The spin became an ordinary maneuver. As soon as the first pilot used a spin as a defensive maneuver in WWI and his opponent watched in satisfaction only to see him recover, it lost all tactical use forever. (This writer, after having conducted spins in many types of airplanes and after chasing spin demonstrations, would like nothing better than to see an opponent in a spin and would be waiting for him at the bottom.)

About 1919, the airplane design theory having changed, spins again began to take their toll of pilots. The flat spin was encountered and the hitherto effective recovery controls would not suffice. This flat spin had a high rotation rate, as high as one turn per second, and an attitude of within 10 to 20 degrees of the horizon. Research provided reasons for this spin and it was endeavored to design the flat spin out of a new airplane by increasing the vertical tail area. This was not totally effective.

Pilots continued to spin airplanes intentionally and unintentionally during the 1920's and 1930's and dur-

Spins

ing this period recovery techniques varied little. Opposite rudder, forward or neutral stick, and neutral ailerons proved the optimum technique. The WWII years produced rapid airplane design improvement. However, the same recovery techniques continued to be applicable. Increased engine power was destabilizing and retarding the throttle for spin recovery was required.

With the advent of the jet engine and the thinning of wings for decreased drag, more and more weight (mass) had to be concentrated in the fuselage. By 1953 it was readily apparent to all pilots that the spin had once again taken on new modes and that past recovery procedures were not obtaining the desired results. The spin was becoming violent and oscillatory about all three axes and, in addition to the known classical spins, now horizontal gyrations occurred. These latter were first encountered on tailless airplanes and in NACA high speed research airplanes. As a result of NACA (now NASA), industry and military efforts, new recovery techniques were established and preventives in the form of control restrictions were used.

It is in this spin era that we find ourselves today. We know how to recover most airplanes from spins. There are some configurations of airplanes that are extremely difficult and sometimes impossible to recover from spins. This article does not attempt to promulgate the final all-encompassing and last word on spins. The intent here is to supplement the Flight Manual with general background information and to discuss the spin as it is known today. General recommendations will be made that apply to most present day airplanes.

RELATED FACTORS

It is not intended to discuss in detail all of the factors that affect a spin. The following facts are stated in brief. The character of a spin entered at 45,000 feet does not differ greatly from one entered at 25,000 feet. However, the equivalent airspeed at which a spin is entered does affect the violence of the spin and spins entered at high equivalent airspeeds feel more violent to the pilot. As the center of gravity of an airplane moves aft the static longitudinal stability decreases and the tendency to pitch up increases. Directional stability deteriorates as the stall is approached, and as the airplane stalls the yawing moment required to initiate a spin may be imparted, though it is not necessary to stall to have this happen. It should be noted also that the exact stall in most high performance airplanes is sometimes hard to define. The airplane is more prone to enter the spin and the rotation rate will be higher in this flatter spin. The airplane will recover with greater difficulty from a flat spin.

With the advent of in-flight refueling higher gross weights are obtainable at altitude. High angles of attack are required to maintain the required lift at these gross weights and the heavy airplane may spin. More energy is acquired in a heavy gross weight spin and a spin of this type will be more difficult to recover from.

It is axiomatic that safety is gained in spinning airplanes at altitudes sufficient to allow complete recovery by 10,000 feet.

Spins in early aircraft were usually fatal. Recovery technique was discovered in 1916 and remained essentially the same through WW II. Flat spins, however, took their toll and improved design partially solved this problem.

Contrary to popular belief, swept wings differ little from straight wings in aerodynamic effect on an airplane in a spin. The F-104 has similar pitchup characteristics to several swept-wing airplanes. As airplanes have progressed through the years the trend has been to concentrate more mass along the longitudinal axis. Fuel, landing gear, electronic equipment, and heavier jet engines are now concentrated in the fuselage. This has a pronounced effect upon the inertial qualities of an airplane in a spin and the recovery procedures.

THE INCIPIENT PHASE

There are three phases to most spins. These are the incipient phase, the spin, and the recovery. All airplanes do not have the incipient phase and some airplanes will not spin. Chance Vought coined the term "post-stall gyration" for the F7U-3.

This airplane never entered a classic erect spin but rather tumbled about all three axes. The motion of the F7U-3 in the post-stall gyration might be considered to be like the incipient phase of a spin. The incipient phase is defined as that transient motion of the airplane between the stall and the fully developed spin.

As the airplane passes through the stall angle-of-attack the flow of air over the control surfaces breaks down and static stability rapidly decreases. After the stall the control surfaces are essentially ineffective and the airplane will pitch about any one or all of the three axes.

During this incipient phase of the spin the pilot will be subjected to varying vertical, lateral, and horizontal load factors. It may be possible for the pilot to recover from this phase. However, abrupt control deflections, either the prescribed spin recovery controls or abrupt control deflects to counter the motion of the airplane, probably will cause the airplane to enter the fully developed spin.

Generally speaking, if the pilot can detect the incipient phase he should release the force on the control that most likely caused the incipient motion and neutralize the other controls and let the airplane fly itself out. Caution must be exercised to not mechanically throw in spin recovery controls.

In most aircraft the incipient phase, if the pilot can detect it, may last from .2 to 10 seconds and ¼ to 3 turns of what may progress into a fully developed spin. Motions that can occur during this phase are snap-rolls, high yaw rates, pitch-up or any combination of these. If neutralizing the controls does not bring about the desired results and the fully developed spin results, it is wise to allow the spin to steady down before recovery is attempted; recovery action cannot be taken until the maneuver is analyzed.

THE SPIN

The fully developed spin has been defined as a motion in which an airplane in flight at some angle of attack above the stall descends towards the earth while rotating about the vertical axis. The angle of attack of the airplane greatly affects the type of spin since the static stability varies from positive at low angles of attack to negative for high angles of attack. It must be remembered that the angle of attack is meas-

Spins

FLAT SPIN

ured from the relative wind to the wing chord line. An angle of attack of 80 degrees can be had in a spin where the attitude is relatively flat in relation to the horizon.

Angles of attack beyond the stall but less than 60 degrees are considered to be low angles of attack and any angle above 60 degrees is considered to be a high angle of attack in spins. Most airplanes will average 45 degrees in the spin. When the spin is fully developed the airplane is at its highest angle of attack with a high rotation rate. If the average angle of attack is decreasing in the spin the airplane is tending to recover. The angle-of-attack indicator, as installed in current airplanes, will be of no help in determining whether a spin is a high or low angle-of-attack spin. It is not installed to indicate this information.

The first turn of a spin can be violent in nature if it is entered at a high equivalent airspeed. The airplane may pitch to a higher angle of attack, oscillate in roll, and/or yaw violently. The second and subsequent turns usually tend to steady down to a continuous oscillatory motion that is characteristic for each airplane design. In the spin the pilot will be thrown left or right. In a spin oscillating in roll and yaw, he will not necessarily be continually forced toward the outside of the spin. Normal load factor will vary with the type of spin. The accelerometer will indicate positive values for erect spins and negative values for inverted spins. In many past spins the accelerometer has been the only available visual reference to determine the type of spin. The pilot must school himself to rely on the turn-and-bank indicator and accelerometer to determine direction and type spin he is in.

THE RECOVERY

The recovery is that phase of the spin from the time recovery controls are initiated until controlled flight is obtained. Each airplane differs in this phase as they do in other phases. Some speed up in rotation rate immediately after recovery controls are applied, others slow up immediately, still others continue in the same manner of spin up to three turns and then recover.

As much as 12 seconds of recovery control has been required on some models before some indication is had that the airplane is going to recover. That is a long time and it is eternally long to the pilot in the spin. Normally some indication of recovery is given the pilot in 3-6 seconds. The pilot must continually analyze his position and not panic in this crucial phase. Allow the airplane to respond to the prescribed recovery controls and then fly it out. There are of course models which recover in less than one turn.

The rate of descent in a spin varies widely and the pilot will probably have to use at least 8000 to 12,000 feet in the recovery phase. All pilots should have an altitude fixed in their minds below which they will leave the airplane. A good rule-of-thumb for current airplanes is to at least be in a diving attitude in controlled flight when passing 10,000 feet above the ground or abandon all attempts to recover and leave the airplane.

Because of the high inertial forces present in the spinning of current airplanes, as discussed previously, the controls used for recovery vary somewhat. Because of the ineffectiveness of the rudder, primarily due to turbulent airflow, another control was needed to aid in recovery. Ailerons were found to offer large enough values of yaw on some aircraft to appreciably aid in recovery. Spoilers have not been found to be effective for recovery from erect spins; they are effective in inverted spins.

The primary use of the elevator is to prevent the airplane from entering an inverted spin from an erect spin and vice versa. The rudder should be used judiciously in the recovery to prevent a continuing spin in the opposite direction. In some airplanes the rudder must be neutralized as soon as the turn needle comes off the stops to prevent this. Each airplane has carefully determined recovery procedures. The pilot must know the proper recovery procedures for the airplane he is flying. His life depends on it.

ERECT SPIN

The three phases are found in the erect and inverted spins. The erect spin is one that is evidenced by positive normal load factors. Since the pilot is now located farther from the center of gravity, he may be subjected to greater longitudinal forces. These forces generally will not exceed 2 to 2.5G. The spin is oscillatory in nature for all current fighters. Generally from 2000 to 4000 feet may be lost in each turn, and the rate of rotation will generally be 3-5 seconds per turn.

INVERTED SPIN

The inverted spin is defined as a maneuver in which an airplane descends towards the earth while rotating with an angular velocity about a vertical axis with a negative load factor and with a negative angle of attack which is greater than that at which the inverted stall occurs. As stated before, many times the pilot's only means of telling whether a spin is erect or inverted is by his accelerometer. There are as many modes to an inverted spin as there are to an erect spin. The airplane may not remain on its back but may roll through 360 degrees during one or several turns. This makes it difficult for the pilot to analyze the spin correctly. The nose of the airplane may remain above the horizon during the entire spin or it may alternate between steeply nose down and up. An inverted spin of this latter type will have high transient negative G and appear to be much "rougher" to the pilot.

In our current aircraft the inverted spins may be oscillatory about all three axes. The pilot is subjected to forces from 0 to -3.5G. It is difficult but possible for the inexperienced spin pilot to overcome these forces and apply the correct controls for recovery. He will most probably not be aware of the high forces exerted on him until the day after the spin when he will become aware of body soreness from lap belt and shoulder harness restraint. On occasion, military and contractor pilots conducting spin programs have broken small blood vessels in these body areas and have had extremely bloodshot eyes for periods up to a week. These have disappeared and no apparent permanent injury or disfigurement has resulted.

High energy spins (continuous high rate of rotation) are more difficult to recover from. It is generally easier to recover from spins that hesitate during each turn. If recovery is initiated just before or during one of these hesitations recovery will probably occur sooner.

ROLL DIVERGENCE

An article on spins would not be complete without discussing roll divergence, or yaw coupling, which can result in a wild and destructive ride. The term "horizontal spin" for this maneuver is a misnomer. Most current airplanes have roll restrictions placed on them, limiting them to 180 degrees to 360 degrees of roll and certain aileron deflections at high equivalent airspeeds. This restriction is probably one of the most important to the military pilot. It is a restriction on his ability to maneuver his airplane tactically but one that must be adhered to.

The placement of the mass of the airplane closer to the longitudinal axis has increased the inertias in yaw and pitch creating undesirable moments. To the pilot who exceeds the roll restrictions for his airplane, it will become apparent that the airplane will accelerate in roll rate coupled with yaw and if continued—pitch. At some point this will become divergent and the pilot may be on a wild destructive ride from which he will be lucky to escape. Roll divergence can be encountered at high equivalent airspeeds and mach numbers after exceeding the allowable rate of roll. Restriction in angle of bank is expressed in the flight manual since angle of bank is more easily judged than rate of roll. If the placarded angle of bank is exceeded while at a high rate of roll, it allows the pitch and yaw moments time to produce divergence.

Unfortunately as most airplanes accelerate in speed they *appear* to become more directionally stable. The airplane will feel directionally stiff to the pilot and lull him into a false sense of security. The rudder becomes less effective when flying at high mach numbers and when directional stability rapidly deteriorates roll divergence can develop and the rudder is not effective to stop the roll. The elevator may not bring about the desired effect because the airplane may have pitched beyond the angle of attack for controlled flight. The experienced or inexperienced pilot when confronted with roll divergence may apply the wrong recovery control as the pre-1916 spin pilot did, and aggravate the situation.

PSYCHOLOGICAL AND PHYSIOLOGICAL ASPECTS

Spins are demonstrated in most Navy airplanes by contractor pilots in order that proper spin recovery techniques will be determined. It is one thing to spin an airplane intentionally and a completely different thing when an inadvertent spin develops. During intentional spins the pilot is keyed up and is aware of

Spins

or suspects the modes of motion that will result. If he is a contractor pilot commencing a new spin program, he has a great amount of engineering data available and conducts his program in a buildup manner, and as he progresses he amasses means of combating physiological factors and overcomes the psychological. This is not without risk but he is prepared, as well as can be expected (including spin chutes), for the ensuing spin. By the time the demonstration is undertaken he is accomplished in recovery techniques.

The pilot thrown into an inadvertent spin is generally immediately disoriented. The immediate surge of adrenalin following an uncontrolled maneuver is followed by a moment or moments of disorientation dependent upon the nature and the violence of the motion. In this period the pilot must reorient his thinking from his just past and intended attitude and flight path to analyze the ensuing incipient spin or spins.

The spin is not a maneuver to be feared. It is to be respected. Most tactical military airplanes are spin demonstrated and spin recovery techniques should be well known. Many pilots have conducted spins, intentional and inadvertent, and pilots will continue to spin airplanes with successful recovery. The following comments may sound awe inspiring but they are included to inform the inexperienced spin pilot just what he might expect. *They seldom would all occur at one time and expecting them will enable the pilot to combat them.*

The fluids in the inner ear, the primary balance organ, are subjected to unusual forces and sometimes transmit false signals to the brain and thence to the motor reflexes. The sensory stimuli from the eyes, muscles and skin of the pilot also send signals to the brain and when unnatural forces are experienced the brain might not cope with this myriad of conflicting information *unless the pilot is trained to combat them.* Orientation in the spin is difficult at times and sometimes impossible without reference to the turn-and-bank indicator and accelerometer.

The pilot might be affected by an immediate marked reduction in mental capacity. He might not know where to look to determine his position in space. He can experience a tunneling type vision and tend to look at one spot outside the aircraft or one instrument. His mind sometimes might become blank even though he is conscious. He would then experience extreme difficulty in concentrating on the required references for recovery. He probably cannot tell whether he is in an erect or inverted spin without referring to the accelerometer. He may make the correct control movements but in the ensuing aircraft gyrations unknowingly relax the forces required for the proper recovery control position. Know and trust the instruments.

Judgment of time becomes inaccurate. The pilot usually requires more time than he thinks to make the proper recovery control movements and then overestimates the time required for response to recovery controls — a natural reaction. The pilot probably will not be able to count accurately the number of turns — this, of course, depends on the violence of the motion to which the body is subjected and the concentration power of the pilot. The direction of the spin is difficult to perceive. He may not be able to tell if the spin reverses without using the turn-and-bank indicator. Experience has shown that the probability of a pilot choosing the proper direction for application of recovery controls without referring to the airplane's instruments is extremely low.

These physiological and psychological factors, i they arise, create a problem that must be solved before the maneuver can be analyzed and the recover made.

When spinning, the pilot can best determine the direction and the type of spin by using the turn-and bank indicator and accelerometer. Looking throug the forward windscreen will give the next best indication. Looking to the side or rear is confusing. H should mentally fight to stay alert and observe hi altimeter as well as the accelerometer and turn-and bank indicator and then observe the airspeed indicato and altimeter during recovery.

- Once recovery controls are used be sure tha they are maintained — don't relax until recovery is assured. Remember that time will seem out of proportion.
- Watch for spin reversals.
- Always be sure you have the proper recover controls applied.
- Have an altitude fixed in your mind belo which, if not in controlled flight, you and the airplan will part company.
- Use the flight manual that applies to you model airplane. The proper spin recovery technique are there and if you fly your airplane as outlined yo can recover from the spin.

Above all remember that your airplane is a weapo with a mission. You cannot afford to compromise th effectiveness of your airplane through ignorance o fear of spins. ★

The item "The D-Ring Is Back," page 12 January issue, was contributed by Charles E. Carroll, Project Engineer, SEG., Wright-Patterson AFB. Sorry his byline was omitted.

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

Q. The method of determining lead points for intercepting an arc from a radial as outlined in AFM 51-37 is based on a rate turn. Do you recommend using rate turns for arc interceptions?

A. No. Use a normal turn for your aircraft. Select the rule of thumb (one-half of one per cent of ground speed for three degrees per second, or one per cent of ground speed for one and one-half degree per second) most applicable to the actual rate produced by your normal turn.

For those aircraft equipped with a Mach indicator, another rule of thumb works fine when wind is not a large factor. Use Mach number minus two as a lead point in miles. For example, Mach .6 minus two equals four miles lead point. If you are not blessed with a Mach indicator, use miles per minute TAS (or ground speed if available) minus two as a lead point. For example, a 360 KTAS is six miles per minute, minus two equals four miles lead necessary for beginning turn to intercept the arc.

POINT TO PONDER

The new AFM 51-37, INSTRUMENT FLYING, is like the latest airplane that is obsolete before it is flown. It's a darn good airplane but someone is already working on a better one. So it is with "The Manual." It has been rewritten, rearranged, added to, cut from and, overall, updated. Yet, hardly a day goes by that we don't wish we could stop the presses and add this or cut that. What has been the philosophy behind the rewrite?

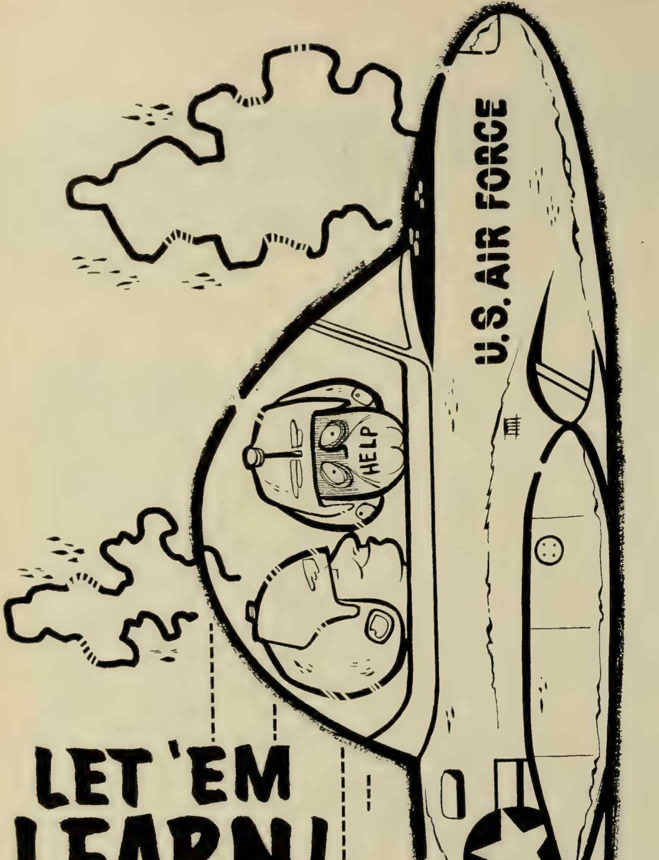
First, we have tried to include answers to problems that you have been haunting us with by phone and letter. For example, the age-old question of "Do I make my missed approach from a GCA at the indicated altitude or should I level off and fly to the visibility minimum?" We have heard it a thousand times and although there is always a lot of talk about leveling off we find no practical reason to do so. If visual references are insufficient to land from a precision approach when minimum altitude is reached, a missed approach is performed. You say, "if visual references are insufficient?" Yes, here again we have tried to face realities. We could say you must have reference to the surface, lights, runway, or overrun but the result is going to be the same—*you, the pilot, will decide.* Your opinion, formed by using all available sources of information, is going to boil down to whether the landing can or can not be made.

This brings up the subject of *judgment.* You will notice in areas like course interceptions, maintaining course, missed approaches, circling approaches, holding, etc., there are limits and, we hope, a good discussion of the factors involved, but there is also room for judgment. Consideration of the factors discussed will enhance the decision process. In the final analysis we have avoided restricting the pilot whose knowledge and experience allow him to perform better, if he can add to the effectiveness of procedures and techniques with good judgment. We hope judgment is not restricted or inhibited in these areas for the sake of standardization or ease of evaluation.

Enough of the philosophy — what should you look for that is changed or new? First of all, note the distribution block — *every* pilot on flying status is authorized a manual. Make sure you get yours! Read the Foreword by the Chief of Staff, USAF. The message is straightforward and the shoe fits most of us who tried it.

The table of contents will show that two completely new chapters have been added. Chapter 6 is Angle of Attack Systems and Chapter 7, The Integrated Flight Instrument System (IFIS). The IFIS chapter encompasses both the flight director and the vertical scale instruments. Most of the remaining chapters have been changed extensively either by rewrite for clarity, added information, or procedural changes. Procedural changes should be noted in the following areas: Course interceptions, maintaining course, holding, procedure turns, penetration, missed approach and unusual attitudes. Added information includes cockpit check, enroute penetration, TACAN malfunctions, runway markings, fix to fix navigation (TACAN), localizer only ILS and many others.

Drafts of the manual were sent to every major command. Each command got its licks in and all approved it and *improved* it. It is your manual, written by us, finalized by you, and endorsed by your command. If you have suggestions for improving it, send them in. Chances are excellent that they will be included in a future revision and you will be able to point with pride to your idea in print. By the way, if you haven't received your copy by the time you read this, look for it real soon. ★



LET 'EM LEARN!

Capt James E. White
3525 Pilot Training Wing
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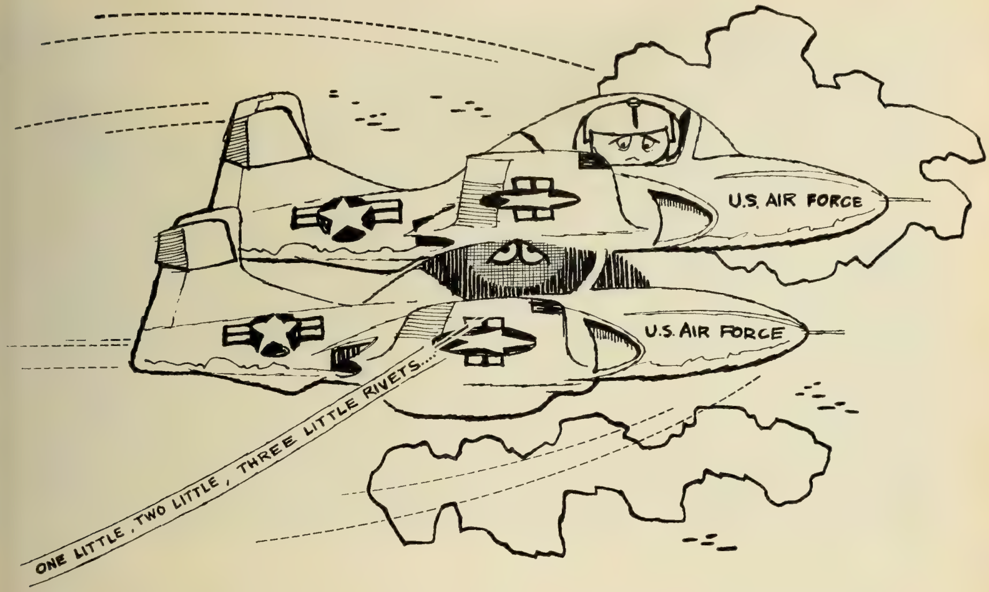
As a student, I felt that my instructor never would let me learn for myself. He was always correcting me *before* I knew what I was doing wrong. So, when I became an instructor, I had one firm conviction: I was going to let my students learn for themselves.

Thus, after 83 hours in BIS, I found myself riding down final in the back seat of a T-Bird. My student was sharp. The final was good, roundout smooth, airspeed pegged. But, we were sitting just about 10 feet too high, and I'm muttering, "Well, any minute now he should be realizing he's too high. Airspeed's getting a mite low. I'VE GOT IT!" Oh, well, what's a few popped rivets? Bet that's the last hard landing he'll ever make.

A few missions later, I'm riding number three in a four-ship join-up out of traffic. I've got a solo on my wing and a good student in the front seat. We're making a real fast tiger join-up. But this tiger was fast getting out of hand. We're closing like a sledge hammer and I'm thinking, he's getting too far ahead of his line. He'd better pull off some power, take some bank out – "I'VE GOT IT!" Power back – "Blue 4, stay low" – zzzzooom . . . missed 'em. Naturally, the lead instructor had a few thousand choice words for me about how far to let a student go. Any other mulehead would have listened, but not me. You see I knew what I'd done – I'd taught a student what a REAL overshoot was like.

Once again I'm riding along wondering just how well my student remembers his vertical recovery procedures. So, back on the stick, in with 5G 'til straight up, "Okay, Lieutenant, you've got it." Wonder what he's doing up there? Airspeed getting pretty low. "Power to 100 per cent." He'd better start rolling soon. "Power, roll to the nearest horizon." Airspeed's getting real low – oh, no! "I'VE GOT IT!" Let's see, throttle idle, rudders neutral, stick full aft . . .

Being exceptionally sharp and highly intelligent, I was getting an idea that maybe I was letting things go just a bit too far. Besides, the old man was beginning to wonder why all my students wanted to SIE (self-initiated elimination). But, just about the time I


U.S. AIR FORCE
U.S. AIR FORCE
ONE LITTLE, TWO LITTLE, THREE LITTLE RIVETS....

had things under control, they grabbed me by the ears, yanked me out of the T-Bird and plunked me into the right seat of the Tweety Bird. Now I had students with only 35 hours, and a few who had never been in an airplane. This was a real opportunity to practice my Golden Rule: "Let 'Em Learn."

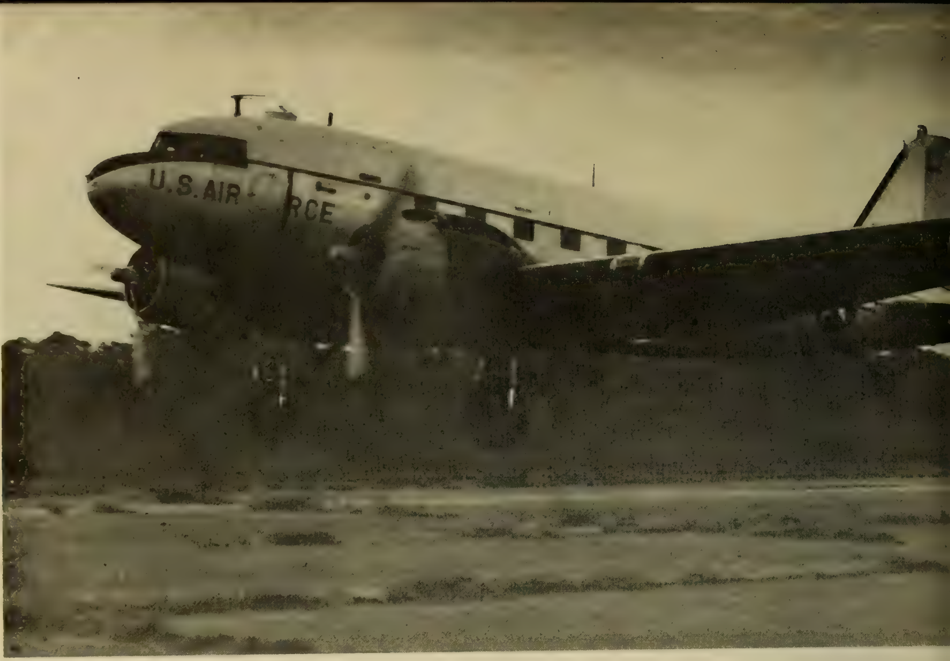
I'm tooling around the pattern with a student who's having trouble with first one thing and then another. Now we're working on a pitch-out. He's got the idea, but his altitude control is poor. So, I've challenged him to see just how close he can hold his altitude in this next pitch. As I said, he's having problems, but he tries so hard that you just can't help going all out to help him. In fact, he's so earnest that he listens very closely, and then devotes 100 per cent of his attention to whatever you've stressed. Into the pitch we go — 10-20 degrees of bank, power back nicely, 30-40 degrees, back pressure excellent, 50-60 degrees, altitude frozen, 80-90 degrees, more back pressure, 100-120 degrees, altimeter unwinding, 130-140 degrees, still rolling, Mobile's screaming, 160 degrees—"I'VE GOT THE AIRCRAFT!"

Again I'm in formation, but this time with a foreign student in the left seat. Automatically, we've got a language problem. But, to add to it, this boy was a champion weight lifter in his own country. You know, the kind of guy who lifts you three inches off the ground just shaking hands? Well, he's doing pretty good — a little rough, but holding position. However, the Tweety Bird has a big, beautiful reference for holding position. The flap hinges extend well below the wing surface; so if you just line up Lead's outbound flap hinge with his helmet, you can't miss — unless you stare at only this reference and lose your depth perception, which is just what happened. We got closer and closer. Finally, something moved. My student suddenly realizes we're much too close. This scares him and he starts pulling back on the stick. "I'VE GOT THE AIRCRAFT!"

But, I don't have that airplane. Sure, I'm pushing on the stick, but it isn't moving. At least not in the same direction I'm pushing. Now I've got both hands on the stick. I'm counting rivets on the other bird. In my normal calm, steady voice, I rupture his eardrum with "I'VE GOT THE **!!ZZ???*|| AIRCRAFT! *?ZZZ|! TURN LOOSE!"

Well, this gives him a big clue about why the stick is so sluggish and he lets go, with me pushing on that stick with every muscle I can muster. Two and one-half negative G later, I regain control and start looking for Lead.

Time has passed and, believe it or not, I'm still hanging on to my convictions to "Let 'em learn." But, if you could listen in on me and my student, you'd hear something like, "No, no, Lieutenant. You've got it all wrong. Start over again. Now start down, smoother, half roll to the right and back up, a little more pressure, now roll to the right, pull it tight. Excellent! Now we got your boots laced, let's go flying." ★



C-47 Short Field Landings

Maj Curtis L. Messex
1st Air Commando Wing
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The procedure for a minimum run landing is the same as for a normal power-on approach power-off landing, *except for the following differences:*

Under *most* minimum run landing conditions, it is preferable to make a wheel landing rather than a three-point landing.

CAUTION

Caution should be exercised when using this technique on sod fields since the possibility of locking a wheel and digging in exists.

Retract the wing flaps immediately upon contact with the ground. This will prevent the aircraft from leaving the ground again and thus make the brakes more effective.

Current C-47 pilots will recognize the above information from T.O. 1C-47-1. This is not much guidance for the low time, newly assigned Gooney Bird pilot. Fortunately, we were able to locate an experienced pilot who instructed and was also officer-in-charge of the C-47 flight training section, Det 8, Forbes AFB. Major Messex took the time from his busy schedule to pass along some of his C-47 experience.

There are two basic techniques for landing the C-47 on short fields. They are considerably different and the selection of the appropriate technique should be based on the mission, the field involved and the prevailing wind conditions.

The most commonly used technique is similar to that which is very sketchily outlined in the C-47 Dash One. This involves a tail-low attitude at touchdown. The type of approach used to get to the touchdown will vary with individual pilot proficiency and preference, but it should generally be a fairly steep, low power approach with full flaps. The steep, low power approach is much safer, due to the power-on stall characteristics of the airplane which generally involve a snap roll one way or the other and a relatively short stall warning period. A high power, flat approach can more easily be terminated with a touchdown at a given spot, but it also involves the very definite risk of a power-on stall precipitated by a wind sheer.

The steep approach can also run into a wind sheer stall, of course, but the power-off stall will fall straight through and give the pilot some margin for recovery. Another disadvantage of the flat approach is that many back country strips are laid out across the tops of ridges and thus come equipped with a built-in down draft right at the approach end. The pilot with a flat approach will frequently find himself looking up at the runway quite suddenly with only a few hundred feet to go. This is disconcerting.

For training purposes, an airspeed of about 75 knots on final with anything from power off to 12-15″ manifold pressure to about 50 feet from the runway (vertically), followed by a power off round out and touchdown on the wheels at the selected spot will work out rather well. The airspeed has a small margin built into it, for the benefit of the IP, and with increased student proficiency it can be lowered a bit more if desired. However, with the heavier loads likely to be encountered during operational use, 70 knots is about as low as you want to go on final unless you know the airplane pretty well.

Touchdown on the wheels, rather than three-point, is usually preferred because the touchdown point can be more precisely controlled by pilots with relatively low experience. In addition, when the airplane is carrying a load the wheel landing is less likely to overstress the tail wheel. Generally speaking, the wheel landing will also use up less total distance (air run plus ground roll) from the last obstacle cleared to the final stop, even though the ground roll may be less with a three-point landing. This last point can be argued either way, however, since there are enough variables to make an individual landing go either way.

The length of the ground roll is determined mostly by the condition of the brakes, the type of surface, its slope, and of course the weight and speed at touchdown. The most critical controllable factors are the speed and the condition of the brakes. Anyone who intends to use a C-47 on short runways should be thoroughly indoctrinated in how to taxi with a very minimum use of the brakes, and maintenance facilities should check brake adjustments on a daily basis. A pilot who sets his throttles at 1000 rpm and rides the brakes to control his taxiing can effectively wipe out a set of brakes just getting out for takeoff on the average airfield. Unfortunately, it usually seems to be the next pilot to fly the aircraft who winds up in the boondocks on the short field.

Assuming good brakes and a good touchdown speed, there remains the question of runway surface and *the possibility mentioned in the T.O. of digging in and nosing over.* Judging by rather extensive experience, the possibility appears to be rather remote under most conditions. A stubborn individual can nose the airplane over by locking the wheels on a strip with good braking action, but full up elevator will counteract maximum braking on hard dirt down to between 25 and 30 miles an hour and the tail will promptly drop when the brakes are released. Grass fields allow the airplanes to slide and you generally can't get the tail to even start up. A very soft surface does present the possibility of digging in and nosing up, but when the surface is soft enough to present a hazard, there isn't much need to use the brakes in the first place. In two cases, at least, the airplane has been landed on fields that allowed it to sink in over the tops of the wheels, and in both cases, full up elevator prevented the nose from striking the ground although in one of the two cases it did bend the pitot tubes. Total "roll" in both incidents was about 300 feet without brakes. An uneven or unprepared surface presents the major hazard. Dropping a wheel into a hole or ditch while braking hard will almost certainly result in disastrous gyrations of one kind or another; pilots should always drag unfamiliar strips before landing to locate such hazards.

Assuming reasonably good braking action, it isn't difficult to stop a 30,000-pound airplane in around 1500 feet of ground run. On the other hand, a grass field with morning dew still on it might take 2500 feet with the brakes locked all the way. The same field an hour or so later might be done in 1500 again. A rainstorm on a clay strip can double the required stopping distance. The question of whether the brakes should be locked probably will not have occurred to pilots accustomed to hard surface operations. Rolling friction is greater than sliding friction on hard surfaces, but on most dirt fields, a sliding tire will be plowing a shallow trench and as a result, will usually be generating more resistance than a rolling tire. A second consideration is that C-47 brakes are usually incapable of generating the optimum 25 per cent rolling slide for any significant distance but can keep the wheels locked, if they are locked before the full weight is on the wheels. Generally speaking, average pilots in average conditions can operate safely on 2000 feet of runway with gross weights up to

The C-47 is still going strong and its crews are operating out of some marginal fields that require utmost in pilot ability.

Special techniques are also required during takeoff from rough short strips.

C-47 Short Field Landings

about 30,000 pounds. Proficient pilots can do with less under favorable conditions, but the question is not so much how much runway is used as it is how much margin of safety you wish to allow. A good deal of uncommon sense must also be exercised to avoid committing people to untenable operations, especially when the determining factor, such as weather, is not under the control of the commander.

The second technique for getting into short fields has a rather limited practical application since the airplane can be put into fields it can't possibly be flown out of without the use of JATO. The basic idea is to make a power-off approach at about five knots above power-off stall, terminating the approach with a rather abrupt flare-out which places the airplane in a three-point or slightly tail first attitude just above the ground. Done properly, the resulting touchdown will usually be rather firm. If the flare is started too high the plane will fall through to a solid impact on the gear, and if the flare is started too low the results are guaranteed to loosen teeth; but if the gross weight is under 26,000 lbs, it takes a really bad one to damage anything other than the pilot's ego. This procedure will get the airplane on the ground and stopped in an absolute minimum distance after passing over an obstacle, but it is not for the novice and there is almost no room for an IP to recover an error. Air run from over a 50 foot obstacle to touchdown can be as low as 300 feet, with no wind. Stopping distances with maximum braking and good surface will be between 500 and 800 feet with the average around 700. Braking techniques are important on this. Best results are obtained by locking the wheels immediately, before the weight on them can prevent it, and allowing the airplane to slide until it starts to swerve, then releasing and reapplying as hard as possible. This can't be practiced on hard surfaced runways, of course — the tires blow. But on dirt they don't even skuff much. Flap retraction is unimportant since the airplane will be almost stopped by the time the flaps get up and retraction does slightly reduce the hydraulic pressure available for braking.

Under some conditions a combination of the two techniques described can be used to advantage. A low power approach to a three-point landing will allow a slightly lower speed at touchdown and result in a somewhat shorter ground run under slippery conditions. For instance, if the pilot is proficient enough to make his touchdown just where he wants it, he can stop sooner than if he touched down on the wheels at the same point. But if he floats a hundred feet trying to get the three pointer, he has thrown away all his advantage and then some.

A note on takeoffs. The procedure in the T.O. has its disadvantages. The tail low attitude will give noticeably less effective rudder control than can be obtained with the tail up. It will also yield more stone damage to the elevator fabric on gravel fields and gives pretty marginal lateral control at lift-off in crosswinds, as well as some rather interesting moments in gusty conditions. A more satisfactory performance can be obtained by setting the flaps in advance to a little over one-fourth, (on *rough* fields any setting made at 39 knots is a WAG) running up to full power with the wheel held full back, releasing the brakes, getting the tail up near level ASAP and rotating at the selected airspeed. There is rarely any need to select an airspeed under 60 for the rotation but this is dependent upon the airfield. With this technique the airplane breaks ground cleanly with positive control and the ground run won't be measurably different from the T.O. procedure.

Initial climb out is usually done at 76 knots for obstacle clearance. Lower airspeeds may be used if necessary, of course, but engine failure below single engine minimum control speed is a hazard that must be considered. There is also the possibility of forcing the airplane into a power-on stall if the nose is brought up too far too soon. (This is where rotation is accomplished around 55 knots and the nose is pulled up past a three-point attitude.)

The T.O. technique has its place on very soft ground where the lift generated by the tail-low attitude helps get the plane out of the mud to where it can accelerate faster. On extremely soft ground, starting a deliberate bounce on the roll will sometimes let you pick enough speed between impacts to stay airborne, but you better have a lot of field to run on if it takes that technique. While on the subject, it is worth noting that there is probably more hazard of nosing up on takeoff than there is on landing. All it takes is a hole, a ditch, a pile of dirt or snow to make the nose bob enough to catch the props, and it doesn't take much of an impact to cause the props to separate from the engine at max power. The left prop may come through the cockpit in such cases and kill one or both pilots. ★

A CASE FOR EAVESDROPPING

Maj Thomas A. Bond
118 Air Transport Group
Berry Fld, Nashville, Tenn

This is a true tale and has a moral. It is an event that happened to me as a civilian, but it could have happened and does happen to any airspace user, civilian or military.

For three years, starting in 1956, I flew as captain with a small scheduled airline. One rainy, dreary, chilly day in February – a typical winter situation – I started a trip just like hundreds of others I had started. Same trip number, same crews, same airways, approaches, radio beacons, ILS frequencies and sometimes even the same passengers. I flew one Convair trip per week and two DC-3 trips per week over the same basic route structure. This particular day's flight was a DC-3 schedule that made eight stops. After the first stop and while taxiing out for the 46-minute IFR flight to the next stop we got the same old clearance; "Southeast 102 cleared to the North Moonshine radio beacon, V-115, maintain four thousand." Enroute WX was forecast to be two to four thousand broken, five thousand overcast with occasional breaks in the overcast.

Takeoff was typical except for one item; while still on ground control frequency before takeoff we heard another airliner, a Convair, receive his clearance; "Blue Ridge 618 cleared to the North Moonshine radio beacon, V-115, maintain five thousand." Readback went like this: "Blue Ridge 618 cleared to the North Moonshine radio beacon, maintain four thousand." This shook me, but since we were ready to go we changed to tower and leaped off. I told the copilot to get the matter straightened out with Departure Control after we were airborne. After changing to Departure Control, the copilot asked them to verify 618's altitude as being five thousand. The controller came back in the affirmative, that he had been assigned five thousand and had read it back as such and was just now airborne at 1437. I guessed then I had misunderstood the Blue Ridge pilot's readback so forgot the incident for the time.

After we completed our after-takeoff call on company frequency, Departure Control cleared us to contact Moonshine Approach Control when we reached a certain fix in the area, then all was quiet. Now my thoughts started to drift back to the Blue Ridge plane and I found myself almost unconsciously easing over to the extreme right side of the airway and mentally computing the time he would overtake me and also wondering if he really was at five thousand. By virtue of knowing both planes' true airspeeds and that we were both getting the same 20 knot headwind component, it was easy to lay out on the Jeppesen Avigation Chart the exact point along V-115 where the Convair would overtake me. By this time I was well to the right of the airway and there were a few breaks in the overcast. The sun was visible at times.

It was now 1447 and the critical moment was 1452; each three minutes the Convair was covering nine miles, and we were covering six miles. Occasionally I would tell myself that my feelings were ridiculous but my thoughts kept returning to the fast overtaking Convair. It was now 1450 and we momentarily broke out into the bright afternoon sunshine, then back into the clouds again. 1451 – out of the clouds again and into quite a large clear area; 1452 – the time had arrived. Now I really wanted to see that Convair, so bad I could almost taste it. 1453 and coming up again soon would be more clouds. Finally, there he was, a good minute and 30 seconds late, that big beautiful blue and white Convair eased on by me about 300 feet to our left. I know the Blue Ridge crew saw me but the fact that I almost knew I would see him and that he didn't expect to see us surely brought about a much different reaction in the two cockpits. Much relieved now, we continued on to destination where I filed a violation against the Blue Ridge flight and he against me. About eight months later I received a letter from the FAA stating that the tower was at fault in not catching the erroneous readback of Blue Ridge 618.

It really paid off for me to be nosy enough to listen in on somebody else's radio transmission and to this day I attempt to keep track of all aircraft in my area by constantly monitoring their radio conversations. ★

Rex Riley

CROSS COUNTRY NO

A FRIEND of Rex's was in a confessing mood the other day. Here's his story.

Flight plan was from Norton AFB to Sheppard at 37,000 feet, in a T-33. The aircraft had been standing in the rain for two days so draining the stick wells momentarily crossed my mind. However, at the aircraft my copilot said, "You take the top and I'll take the bottom." Preflight completed, we set sail for Sheppard. Half way there I noticed the ailerons were difficult to move and asked him if he had turned my boost off. He replied "negative," so I assumed there was ice in the stick well but that it should thaw once we were below freezing level. Aileron control did return at 4000 feet.

After we were turned over to Sheppard GCA, a descent of 500 fpm was established at 120 kts. Then I noticed that I had no back stick left. I asked the copilot if he had anything lodged behind the stick and he said he hadn't. Since I didn't relish smashing into the runway at 500 fpm, I asked him to get on the stick with me in an attempt to get it back farther. We both jerked at the same time and the stick broke free. I made my normal hairy landing and taxied in. After we parked the bird, the Sheppard T/A personnel got to work chopping ice out of the stick wells. Two hours later they were still chopping.

Looking back on the incident, I asked myself what I would have done if I had been alone. I know I couldn't have broken that ice by myself. The answer was clear, and I probably would have thought of it on go around: simply pull up the flaps and make a no flapper. I had enough stick travel to round out without flaps. Better still though, on preflight I'll say, "You get the top and I'll get the bottom." That's easier anyway.

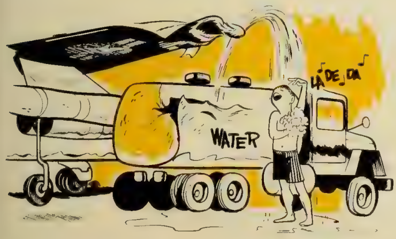
AFTER WATCHING a transient pilot give special care to his T-Bird and then take off, Rex heard someone remark, "He looked like he was freezing to death, shivering in his summer flying suit as he knocked icicles off the tiptanks." Then a bull session developed around the question "Why the summer flying suit in a winter environment?"

That transient pilot in summer clothes was risking not only his fine young neck, but also his reliable old T-Bird. Suppose the bird's heating system had failed? A cold pilot is a flying hazard. Suppose this one had a punchout? He might face the same plight that a crew of six experienced a few years back when they bailed out over mountainous terrain during a freezing weather. Some made it okay; those who didn't were found within a few hours. Their stiff bodies in summer flying clothes were direct evidence of the cause of their deaths.

It has been repeated so many times but because of that shivering T-Bird pilot who attracted attention: *When flight is planned over or to a cold area, dress for it!* February weather is cold weather at many bases.

SAFETY MARK – Rex takes his hat off to the 21 Troop Carrier Squadron. The outfit has flown 150,000 hours without an accident and has won just about every safety award in the books. In fact, the unit's last accident was 'way back in 1952, during the Korean War.

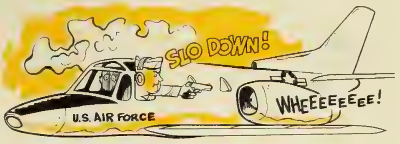
The 21st operates out of Okinawa and its crews fly over just about every type of terrain there is and in all kinds of weather. They have been flying C-130's since 1958 and prior to that C-54's and '119's. Over the years a lot of men have contributed to this safety record and Rex thinks their motto is a worthy one: "If I had my choice when waging war, I would choose not the weight of men and guns, but men with esprit de corps."



MAINTENANCE had just been completed on a B-52 and an MA2 tow vehicle was being used to tow the aircraft back to the ramp. The ramp of the nose dock where the work had been performed was wet with patches of ice. While the aircraft was being backed, the right wingtip struck a water truck parked nearby, causing minor damage to the truck and a damaged wingtip on the bomber.

The tow crew was properly positioned and the team chief had a checklist, but he was not on interphone to the man in the cockpit.

Prevention of these mishaps seems obvious, but somehow the word doesn't always get around and these little accidents cost the Air Force a lot of time and dollars. Instructions now include a requirement to remove all equipment needed for a job from the immediate area as soon as the job is completed.


SLO DOWN!
WHEEEEEEEE!
U.S. AIR FORCE

TURN IT ON . . . to . . . TURN IT OFF. Rex recently noticed the following item in North American's Operation and Service News and is passing it on for the edification of all T-39 drivers.

Ironically, sometimes you have to do just that – turn it on to turn it off. Here is a case where an on-off control could not do its job because the necessary power was not available. The T-39A was cruising at about 94 per cent rpm when the pilot noticed the Nr 1 engine increased to 97 per cent. He retarded the left engine throttle. However, the throttle had no effect. The same throttle was then stopcocked. Still no effect, and the engine continued to run along at a steady 97 per cent. Next step was to turn the engine master switch OFF. This surely will kill the stubborn beast, thought the pilot. But alas, he might as well have turned on the windshield wipers, for the fuel fail caution light did not come on and the engine continued to maintain 97 per cent. Next, the pilot pulled the left fuel boost pump circuit breaker while thinking: If we can't choke it off, we'll starve it to death. This time, the fuel fail caution light came on, but that was the only change in the situation, for what the pilot hadn't figured on was that reliable engine-driven fuel pump which was maintaining fuel flow at 1800 pph, and the engine continued to run a steady 97 per cent.

Finally, the pilot pulled the left fire pull "T" handle with one hand while he grabbed the microphone with the other. The engine did not respond, but the radio did, and the Wing Command Post advised the crew to check that all circuit breakers were set (in). It was then noticed that the engine master switch circuit breaker was popped. The circuit breaker was promptly reset, and the speeding engine died immediately.

The airplane descended and made a safe single-engine landing; it was then determined that the primary cause of the unusual incident was a failure of the left aft push-pull throttle control assembly rod (Part Nr 265-437016-21). All pilots at the base where this airplane is assigned were briefed on the incident, with particular emphasis on the fact that the engine master switch circuit breaker must be set to ensure that electrical power is available to accomplish engine shutdown with either engine master switch OFF or either fire pull "T" handle pulled. In fact, any time an inflight abnormal condition exists, it is a good practice to first check your circuit breakers.

Snow Guide

Winter is well established by now so a reminder to prepare for it would be a little late. However, new guidance, on winter protection in the form of an interim operation guide has recently been distributed to Air Force commands and all bases probably have not seen it yet. This guide, *Snow Removal and Ice Control,* contains a wealth of information and will be available as an official Technical Order by September 1966.

Current publications, AFR 90-6 and AFM 85-8, have been the standards for ice and snow protection for many years. The new guide contains more information and will undoubtedly be welcomed wherever arctic-like conditions prevail during the winter months.

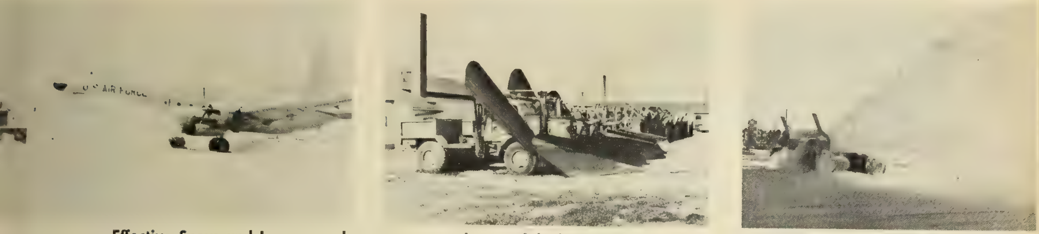
While we can't print the whole thing here, a brief rundown on the contents, with particular attention to some areas, seems worthwhile.

Certainly one of the first steps toward effective winter protection is organization that will assure that the task will be accomplished effectively. The guide calls for formation of a Base Snow and Ice Control Committee and is specific as to its membership. Chairman is the Base Deputy Civil Engineer who is directly responsible to the Base Commander for base snow removal activities. The guide then spells out the responsibilities of each member of the committee.

Basically, members of the committee are responsible for planning and preparing prior to the onset of winter, defining responsibilities and jurisdiction of involved activities, and generally providing plans and schedules that will permit maximum safe operation of the airfield and the base area.

To illustrate the scope of responsibilities, consider those of the DCO.

- Runway serviceability inspections.
- Declaring aerodrome surfaces serviceable or unserviceable for flying activities.
- Advising priority requirements for clearing aerodrome surfaces.
- Advising alternate procedures to be used in the event of a flying emergency.



Effective Snow and Ice removal programs require careful planning, mobilization of all resources.

- Promulgation of orders and instructions in respect to:

1. Vehicular traffic and communication procedures on aerodromes areas.
2. Parking of aircraft and restriction of unnecessary flying in order to facilitate snow and ice control operations.

- Providing meterological services (weather forecast).

For maximum effectiveness and control of the various activities involved, a central Snow Removal and Ice Control point will be established under the supervision of a Work Center Controller, who is responsible for scheduling, control, and coordinating functions.

Pre-season preparation will prevent a lot of winter headaches. Those who wish to avoid eating a lot of APC's will prepare by:

- Selecting and training equipment operators at least two months prior to the onset of winter operations. Selection should be on a basis of desire and ability, not on random grabbing of bodies. Training should be well thought out and include specifics such as duties, when, whom and where to report to, base familiarization, the equipment being used and its characteristics, communications procedures and techniques, and procedures for snow and ice removal and compaction.
- Conditioning and storing of equipment. This should begin for the coming winter season at the termination of current winter operations, and no later than June 1. The job should be done, according to the Guide, by September 1 at northern bases and October 1 at other bases.
- Acquiring proper snow control materials such as sand, chemicals, markers, stakes, snow fences, etc. Materials should be stockpiled by September 15, with adequate reserves and provisions for reorders.
- Preparing aerodrome and road surfaces and facilities. Hazards should be eliminated or marked, boundaries of runways, taxiways, ramps, roads and walks marked, pavement repaired, overruns cleared and graded, etc.

SNOW REMOVAL

There are a variety of techniques and types of vehicles that are employed in snow and ice removal. Factors affecting the selection of techniques and vehicles to be used include geographical location, wind velocity and direction, snow characteristics (wet or dry), the equipment available, types of aircraft and others. For example, when a rotary sweeper is available and the snowfall is light and dry, removal should begin with the start of the snowfall and continue until it quits. When these sweepers are not available, other techniques are necessary:

- After two inches of snow have fallen and there is a forecast for continued precipitation of at least three inches;
- Immediately after snow has stopped falling, regardless of depth, and there is no indication of freezing rain; and
- When drifting conditions make emergency operations hazardous.

The appropriate procedures and equipment are spelled out in the Guide for almost any condition that can be foreseen.

ICE REMOVAL

Ice is formed in many ways and once it has reached any appreciable thickness, it is difficult to remove from runway surfaces. The Guide lists some precautions that can be taken to reduce or prevent ice formation. These are:

- Maintain the closest liaison possible with the Base Weather Office to ensure receipt of the latest weather forecast information;
- Commence sweeping operations as soon as precipitation of any kind begins;
- Provide and maintain adequate drainage facilities; and
- Restrict aerodrome traffic to essential and emergency requirements.

Methods of treating ice covered runways and other surfaces used by vehicles are discussed in detail. The spreading of sand, water over sand, and the use of chemicals approved by USAF are effective means of treating ice covered aerodrome surfaces depending upon circumstances. Proper use of snowplows and rotary sweepers is also effective, again depending on circumstances. Chemicals are effective on ice not exceeding one-fourth inch in thickness, when used at the proper temperatures and when properly spread. Since chemicals alone won't do the job, and mechanical means must be employed anyway, sweeping and plowing are the primary means of ice removal. Other factors are the cost of chemicals, their corrosion properties and spalling effect on concrete.

COMMUNICATIONS

If there is anything that makes operations people nervous it's the

CHEMICAL DE-ICERS

The tremendous cost of ice and snow removal from surfaces used by aircraft has caused the Air Force and civil airport operators and users to search vigorously for some magic elixir that would instantaneously, economically and effectively perform this task.

Alas! There is no magic elixir. At least not so far. But there have been developments that show promise.

On the face of it, developing such a chemical may seem relatively simple. Common rock salt does a very good job of melting ice. But rock salt is very corrosive to many metals. Chemists have come up with many other formulas, but few have met these tests:

- Must be non-corrosive.
- Economical.
- Easy to store and handle.
- Lack deleterious effects on concrete and asphalt.
- Easy to apply.

De-icers currently being used are alcohol and urea. The Air Force is studying at least six fluid and four solid chemicals. Those approved for use will be listed in the forthcoming ice and snow control technical order.

In a study for the FAA, Monsanto Research Corporation investigated a number of chemicals with de-icing properties. They found that a mixture of 75 per cent tri-potassium-25 per cent formamide was effective and that it possessed good corrosion control properties.

De-icing chemicals are a distinct aid, but mechnical methods still must be used to clean the runways and other aerodrome surfaces. For this reason, and the cost of chemicals, snow plows, rotary sweepers and other mechanical methods continue to be the primary means of ice and snow removal. ★

sight of a lot of ground vehicles operating on runways, taxiways and ramps. This concern can be mitigated somewhat when effective communications with the operators of these vehicles is assured. When snow removal vehicles are operating on the airpatch, good communications is absolutely necessary. Standard phraseology is required, unnecessary chatter between vehicle operators must be eliminated, there should be provisions for communications failure, for emergency clearing of the active runway and for permission to enter a runway. Light signals must be understood and drivers must be on the lookout for such signals.

SAFETY

No one pretends that snow removal is the safest occupation in the world. In fact, there are many ways in which a snow plow or sweeper operator can get hurt or killed. Therefore, safety precautions are a must during these activities. The Guide presents a long list of precautions for operators. If these are followed and the safety people exercise good supervision of safety practices, the number of accidents can be lessened considerably. Extracts from the list of precautions are included at the end of this story, since winter conditions will exist at many bases for several more months and because they constitute a handy checklist for both safety officers and vehicle operators.

While much of the contents of the Guide is not new and most of the snow removal methods have been in use for years, there is some new material and the Guide is much more detailed and specific than current publications. Much of it is based on an RCAF document and you've got to admit that the Canadians ought to know quite a bit about ice and snow control. We hope we've whetted your appetite and that the new T.O. will arrive in time for planning next winter's program.

* * * * *

OPERATOR(S) INSTRUCTIONS AND PRECAUTIONS

Know and observe all safety rules and regulations pertaining to the movement of vehicles and equipment on aerodromes, roads, and other ground surfaces.

Keep vehicle cab well ventilated at all times to prevent the accumulation of dangerous gases.

Use safety belts at all times where provided.

When working on a vehicle or equipment do not permit anyone in the cab or at the controls.

To prevent personal injury, keep vehicle running boards, steps and cat walks clear of snow and ice.

Always obtain clearance from the Aerodrome Controller, via R/T transmission or telephone, prior t commencing operations on aerodrome areas. Also obtain clearance as necessary during the course o operation and when departing from these areas.

When required to operate nonradio equipped vehicles or equipment on aerodrome areas, refer visually to the control tower at frequent intervals for warning an clearance signals.

Allow aircraft the right of wa at all times, and where necessar bring vehicle or equipment to complete stop well clear of th runway or taxiway.

Keep the speed of equipmen down to a minimum when operating in the vicinity of aircraft, vehicles and other equipment.

Maintain safe distances at al times when operating in conjunction with other snow and ice control equipment.

Be constantly alert for aircraft other vehicles and equipment, an for obstructions such as heave surfaces, expansion cracks, raise sewer coverings, curbing, aircraf chocks, mats, and other loose o fixed obstructions that may caus serious damage to equipment.

When operating high speed type of equipment, ensure that speed are reduced in sufficient time t allow for safe control at all times particularly when turning.

Use extra caution when towin high speed rotary sweepers on slippery surfaces. Refrain from sudde stops, harsh braking and fast turns as this practice will cause th sweeper to jacknife, which can result in damage to both pieces o equipment. ★

Key Points for Snow and Ice Removal

- Ensure equipment is overhauled and ready to go well in advance of expected snow season.
- Keep snow and ice control vehicles in heated garages for carefree starting and maintenance. Indoor parking of this equipment should be given precedence over less costly vehicles such as staff cars, station wagons, panel and pick-up trucks.
- Be sure that lights on the snow handling machines are high enough to clear the plows.
- Have chains ready for all wheels of trucks or rubber-tired tractor units, but don't use them until wheels begin to spin or side thrust develops.
- Keep sufficient stocks of fast moving parts on hand to carry out running repairs to equipment being operated.
- Prior to the snow season inspect and ensure that all unpaved areas where equipment will be required to be operated are free of rocks and other foreign debris.
- Prior to the snow season ensure that adequate markers are installed to indicate the exact location of all obstructions which may become snow covered and hazardous.
- Provide heated accomodation for stockpiling of sand. If required to stockpile outdoors keep it covered with tarpaulin.
- Where possible keep at least two sanding vehicles fully loaded and readily available in heated storage, to meet emergency requirements.
- Keep informed on the latest weather data so that operators and equipment are prepared to meet forecasted conditions.
- Keep snow off the operational runways, fire, ambulance and access routes. It has to come off some time so keep it off currently.
- Turn the runway lights on day or night when the snow starts. Their heat will help to prevent snow from covering and obscuring the lights. They also help to define the areas to be cleared, and provide a source of guidance for operators, particularly when operating at night and when adverse weather conditions prevail.
- Keep width of runway open and slope banks at the most one foot in 20 feet. Rolling snow outside the cleared areas will help to prevent drifting.
- Keep the sides or shoulders of taxi-strips, runways, ramps, tarmarcs, overshoot areas, roads, etc., clear of snow far enough back to eliminate hazards to the operation of both aircraft and mobile equipment.
- Maintain good visibility over snowbanks at all intersections.
- Keep operating surfaces free of frozen lumps of snow, ice, sand, and other foreign debris which may constitute a hazard to the operation of both aircraft and vehicles.
- Keep snow removal areas free of equipment such as aircraft chocks, tow-bars, run-up mats, etc., when not in use. Failure to do so can result in costly damage to snow removal equipment, particularly rotary snowblowers.
- Provide sufficient area of traction to enable safe control of both aircraft and mobile equipment when conditions of ice and compacted snow are encountered.
- Mark the location of all water drainage channels and ensure that they are free to function after every snowstorm.
- Where snowplows are used alone, be sure to open a sufficient width on the first plowing to permit piling subsequent snow inside the banks.
- When two speeds are available on rotary snowblowers, use slow speeds on heavy wet snow and high speeds on dry snow.
- Be sure that warning (blue and red) flasher lights are turned on at all times when operating.
- If weather forecasts indicate that a freezing rain is imminent after a snowfall, allow the snow to be left on the surface for absorption purposes.
- Have all equipment correctly operated, by the most competent personnel. All operators are not good operators, and many dollars in repairs can be avoided, as well as better results obtained.
- Start clearing operations or other processing of snow in conformity with the storm, and ensure that operations are continued until the snow is under control.
- Complete secondary snow clearing requirements between storms or during quiet periods as quickly as possible to prevent serious situations that can arise should storms recur at short intervals.

GIVE THE BRAKES A BREAK

Lt Col J. D. Oliver, Jr
Directorate of Aerospace Safety

It is easy to cause brake problems in any aircraft: just put a few pounds of lead in your shoes, taxi for awhile at freeway speed limits, roll up and down the runways a few times to make sure the brakes are working before you commit yourself to flight. Depending on the bird, the weight and how much lead you put in your boots, you can melt down a few wheels, vaporize the tires and guarantee that the brakes will heat up the coffee pot in nothing flat.

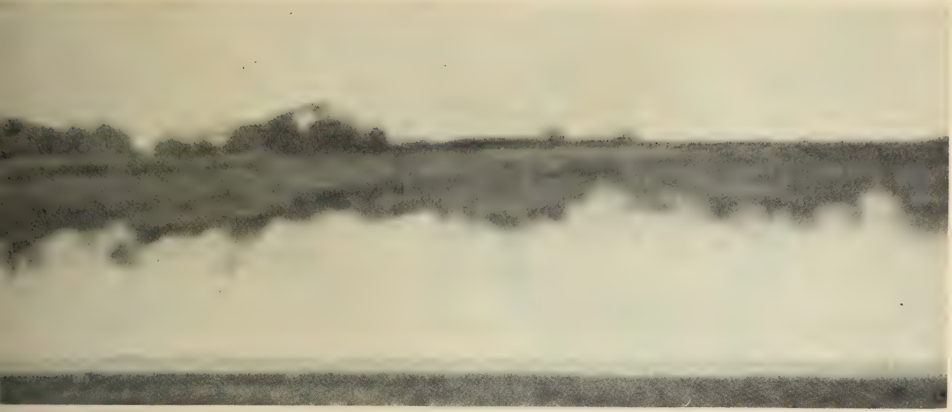
Every safety pub hits brake problems frequently and with good cause. Here's ours for this month. It concerns three incidents, all in the same type aircraft, in which braking, or the lack thereof, was a factor. But as you will see, the malfunctions weren't in the machinery on the airplanes but, rather, in the mechanism between some individual's ears.

HEAT AND HEAVY WEIGHT LANDING

The first incident resulted in a wheel and tire fire with damage to the underside of the fuselage, wiring in the right wheel well, inboard trailing edge of wing and right wing flap. The aircraft was scheduled for a functional test flight following a T.O. compliance. During taxi-out wheel brake operation was normal with no evidence of grabbing or dragging. After 30 minutes of flight, the aircraft entered the traffic pattern for a full stop landing. Final approach gross weight was 16,000 pounds, approach was flown at 119 knots, with touchdown at 110 knots approximately 100 feet past runway threshold. Flaps were raised and intermittent brake pressures were applied. Directional control and braking action were normal.

Just before turning off at the end, both pilots felt what they thought was a rough spot in the runway. Then, shortly after the aircraft cleared the runway, a golfer ran out of an adjacent golf course waving his arms and pointing to the underside of the aircraft. The pilot notified the tower, stopped the aircraft, and deplaned with hand fire extinguisher to find the right wheel and tire on fire. The extinguisher controlled the blaze somewhat until the fire department arrived to extinguish the fire.

Investigation at the scene and query of the golfer revealed the fire started at about the time the aircraft turned off the runway. A teardown was performed on the wheel and brake assembly, but it was impossible to determine the condition of some components prior to the incident. As far as could be determined all components were functioning properly. Pilot braking technique was normal throughout the landing roll with moderate, steady braking just before turnoff. Neither pilot could account for the rough spot because the runway is smooth. A dragging or grabbing brake could cause this sensation, but the rough feeling was only momentary and there was no evidence to the pilots of brake malfunction.



Brake problems continue but sometimes the malfunction is caused by the human factor.

It was concluded that no single factor was responsible for this incident. A combination of lack of complete brake cooling during the short flight, heavy gross weight landing and additional brake heat generated during landing roll all contributed to the ultimate result, an overheated brake and subsequent tire fire.

NO FLUID, NO BRAKES

Sloppy maintenance created our next brake incident. A T-39 was being guided, by transient alert, into a parking spot after cross-country flight. Operation of the hydraulic system had appeared normal until brakes were applied to stop. Normal brakes did not work and the aircraft continued rolling until it hit the transient alert truck. The pilot reported that the hydraulic power off warning light did not come on at any time. Ground investigation disclosed that the hydraulic reservoir cap was completely off the reservoir and the reservoir was empty of hydraulic fluid. The system was checked and the lack of fluid in the hydraulic pump had caused it to fail. The complete loss of pressure occurred too late for the pilots to diagnose the problem and use emergency brakes before hitting the transient alert vehicle.

CHECKLIST

A T-39 had parked and shut down engines to offload passengers. After the passengers deplaned, the aircraft was to be moved to a new location for departure. The engines were started and a hard right turn was initiated, but, due to the limited ramp area, the turn could not be completed. Engines were shut down and the aircraft was rolled backward to provide more turning room. The engines were restarted by the crew chief who then left the cockpit. The pilot taxied the aircraft forward and entered a right turn. Then when a left turn was attempted, there was no nosewheel steering. The pilot tried the brakes but they didn't work. He then went for the emergency brake handle and pumped the brakes to get pressure. Too late — the aircraft hit a two-strand fence. Five posts were knocked or pulled over before the aircraft stopped. Total distance from start of emergency brake action to stop was approximately two aircraft lengths, but that was far enough to produce a dented intermediate slot and dents in the sheet metal on the right nosewheel door and right wing.

Cause of this brake failure was failure to use the checklist. During engine starting, the pilot and the crew chief both missed the hydraulic pump switch. Thus the pump never got turned on. No pump, no pressure, no brakes.

Brakes are subject to enough problems without adding to them by an unprofessional approach to crew duties. Why land from a test flight at heavy gross weight? A lighter fuel load on takeoff or fuel dumping could easily have prevented that one. A few extra moments spent insuring proper fit of the reservoir cap would have kept the hydraulic fluid where it belonged, providing pressure for the brakes, and there would have been no accident. Memory can never replace proper use of the checklist, and until crew members learn this we will continue to have such incidents and accidents. ★

THE UNSEEING I..........R

Willie Hammer
Directorate of Aerospace Safety

Guidance failure of infrared (IR) homing systems is a common cause of incidents involving air-to-air missiles. Missiles involved in such incidents are destroyed either by a self-destruct system or by impact with the ground, making it impossible to determine whether the failure was due to malfunction of the missile's electromechanical devices, or to one or more of the detection system performance limitations being exceeded. This article presents basic information on conditions which affect and limit employment of infrared homing systems.

Three elements must be considered in any homing system: the target, the detection and guidance system, and the medium between the two. Infrared equipment in air-to-air missiles is designed for "passive" homing: the radiation which it detects is generated and emitted by the target itself. Unlike radar, infrared systems do not depend on a reflected signal originated by the attacking missile or aircraft.

All bodies having temperatures above absolute zero contain heat energy and emit infrared radiation (electromagnetic radiation between the region of visible light on one hand and ultrashort radio waves on the other). Expressed in wavelengths, this range is from about 0.70 to 750 microns. IR guided air-to-air missiles operate with radiations having wavelengths up to 15 microns.

The temperature of any body is not absolutely uniform; therefore, it radiates at all wavelengths up to that for the highest temperature present. As the temperature of the body is increased, radiated power increases at all wavelengths, but the increase is proportionately greater at the shorter wavelengths. As the temperature increases, the maximum intensity of radiation emitted will occur more and more towards the lower wavelengths. As Fig. 1 indicates, the sun, with a surface temperature of 10,000° F., has its maximum intensity of emission at 0.5 micron, while a body at 80° F. has its maximum at about 10 microns.

The amount of radiation emitted by any body is also affected by two other factors: its surface properties and its dimensions. The amount of radiation actually emitted by a body at a specific temperature will not reach the ideal indicated from calculations based on its temperature. Only a "black body" will achieve the ideal, and such bodies do not exist in nature. The ratio of actual heat energy emitted to the ideal emission at that temperature is called the "emissivity" of that body or surface. Dark surfaces have higher emissivities than light; organic surfaces higher than metallic; rough surfaces higher than smooth; and solids higher than gases. Different bodies of the same size and temperature may therefore radiate different amounts of infrared energy. Engineers compare radiation of materials at different absolute temperatures and emissivities by assigning them equivalent "apparent" temperatures. Apparent temperature is that single temperature that a black body would have to maintain to provide the same rate of emissions. The higher the ap-

Fig. 1. Infrared Radiation Wavelengths at Various Temperatures

Object	Approx. Temp. °F	Wavelength of Max. Intensity (Microns)
Sun	10,000	0.5
Room Temperature	80	9.7
Magnesium Flare	3,600	1.3
Jet Engine	900-1100	3-2
Piston Engine	750- 900	4-3
Engine Covers	200	7.8
Skin of Jet Acft @ Mach 1.5	140	8.7
Skin of Jet Acft @ Mach 2.0	252	7.3
Bell X-2 Skin @ Mach 3.0	632	4.8
Rocket Exhaust	3000-5000	1.2-0.9

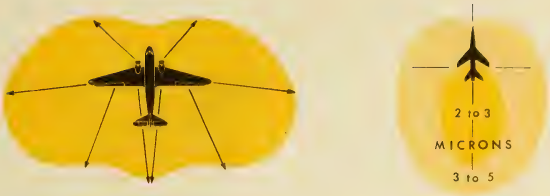
parent temperature, the higher will be the intensity of radiation from the source.

Size and configuration of a radiating body are important, size because a large body or surface will emit more energy, other factors being the same, than a small one, and a large body can be detected more easily than a small one of similar apparent temperature and configuration.

Configuration relates to the shape of the body. If it is complex and has radiating surfaces that face each other, energy will be reflected back and forth, and little lost. If there are no facing surfaces, radiation will be outward in all directions. However, a detector will be able to "see" only a small portion of the total amount emitted. The surface of importance to the detector is the area which is included within the lines of sight between the target and the receiver. An aircraft viewed headon has a much smaller projected area than when seen from the side.

By considering temperature, emissivity, and dimensions, a radiation pattern can be approximated for any aircraft. Two of these are shown in Fig. 2. Directions from which attacks can be launched for successful results can be seen quite readily from such patterns. If the missile is designed for the detection of radiation in the 2-3 micron band, the jet shown should be attacked only from the narrow sector at its rear. If the missile can detect 3-5 micron radiation, attacks can be made from almost any direction, but most successfully from the rear.

These pattern outlines indicate comparative strengths of infrared radiations at different wavelengths and not the limits at which these radiations can be detected. Radiation is strongest from the hot engines and engine exhausts. It is weaker from the skin of the aircraft where heat is generated by friction and aerodynamic braking of air. The radiation patterns of high-speed aircraft are distorted rearward, compared with piston engine aircraft, because of the long, hot, jet exhausts. Skin effects and power output of any specific aircraft will increase with speed, increasing radiation, and in some respects, make the aircraft easier to detect.



Radiation Pattern of C-47
Due to Engines and Exhausts

Over-all Radiation Pattern
of a Jet Aircraft

Fig. 2. Radiation Patterns of Different Type Aircraft

DETECTION AND GUIDANCE

Detection equipment in a missile designed to home on high-speed aircraft must be extremely sensitive. It must pick up small amounts of radiation emitted from thousands of feet to many miles away. And detection reaction must be rapid. Certain types of receivers used in laboratories are extremely sensitive but are impractical for use in air-to-air missiles since their reaction times are too long.

A missile IR detector has the ability to rapidly convert infrared radiation into an electrical signal. The signal produced by the receiver can then be amplified and used to provide guidance to the missile. This type of receiver uses a photoresistor element consisting of a thin, high-resistance film of semiconductors such as lead sulfide, lead telluride, and lead selenide; indium antimonide, and indium arsenide; germanium alloys, and gallium antimonide, each of which has the ability to detect infrared radiation of definite frequencies only, usually within narrow ranges. When infrared radiation hits these semiconductors, free electrons appear in the layer of film. Electrical resistance of the film decreases and the voltage across the receiver drops. The film is connected into a power circuit, and the voltage changes which result are used to modulate downstream units. Reaction time with this type of system is extremely rapid, ranging from a few millionths up to a few thousandths of a second.

Cooling of photoresistors increases their sensitivities so they can detect radiations of longer wavelengths. Detector temperature in an air-to-air missile is reduced by the cooling effect created by an expanding gas. A gas, such as nitrogen or helium, is compressed to an extremely high pressure, at which it may be stored indefinitely. In use, the gas is released through a very fine hole or filter. As it expands, it absorbs energy in the form of heat, causing the temperature to drop and the detector to cool. The chief disadvantage of this method is that the fine holes may be stopped up by contaminants in the gas or by moisture which may freeze. In this case, the sensitivity of the receiver would be reduced, decreasing the range of the system, or eliminated entirely, causing complete failure.

An infrared detection system can determine the strength of the radiation it receives, but not the distance to the source (a large object at a great distance may indicate the same intensity as a small, nearby object). An IR system thus lacks an ability which radar possesses. By use of a suitable electromechanical device, called a modulator, an infrared system can be used to determine *direction* to a target.

The modulator is a rotating disk made up of alternating transparent and opaque areas arranged in a regular pattern. Generally, two are used to provide information on directions along both the horizontal and vertical planes. Radiation received from the target is focused into a narrow beam which hits these modulator disks. If it hits a transparent sector, it passes through to the sensing element; otherwise, it is reflected. The frequency of current which results is a measure of the difference in angle between the lines of sight and flight. Suitable control corrections can then be made. When the missile is on a proper course, the radiation beam will hit a constantly opaque area, the system will be in equilibrium, and no directional change will take place.

The transparency of the missile nose cowling and the atmosphere through which radiation must pass is extremely important. Not all transparent materials will pass infrared radiation. Some of them will pass only certain wavelengths. The substance used for these cowlings, or *irdomes,* must correlate with the wavelengths to be detected. Conventional glass will pass radiation below 3 microns in wave length; other materials must be used for wavelengths longer than this. Arsenic trisulfide will pass about 70 per cent of any infrared energy of 1.5 to 10 microns, and the percentage can be increased by use of special optical coatings. Conversely, the presence of dirt, scratches, finger marks, oil or moisture films, or other foreign material, may degrade the ability of an irdome to pass radiation. A cracked irdome may permit warm air to hit the receiver, which would reduce its sensitivity.

AIR CONTAMINANTS

Various constituents of air will also act as obstacles to the passage of infrared radiation. Molecules of carbon dioxide, water vapor, and ozone will absorb energy or cause its scattering. Particles of dust, smoke, pollen, salt, bacteria, ice, and drops of water will interfere in the same way. Here, again, the absorption of energy is selective so that certain wavelengths are affected more or less than others. Frequencies at which little or no absorption takes place are called "windows." The atmosphere may absorb as much as 100 per cent of the radiation at other wavelengths. Windows for air at sea level are shown in Fig. 3. The widths of these windows will increase with altitude as the density of air and the amount of water vapor present decrease.

The wavelengths for which an air-to-air missile detection system is designed are therefore critical. The detection ability of a receiver is affected by the lack of windows at those wavelengths, the transparency of the irdome, and the target temperature. A missile designed to detect only low temperature, long wavelength radiation may miss a much brighter and hotter target radiating at much lower wavelengths. For example, a magnesium flare is extremely bright and attractive to the human eye, but its infrared radiation may be unsuitable for homing of a missile.

Similarly, a missile developed for high altitude use, where little air or water vapor is present, may not home on a low altitude target, especially in rain or under high humidity conditions. The range of a missile may be reduced substantially in such cases, far below that indicated in operating procedures under design conditions for that missile. The receiver requires a specific minimum amount of radiation to operate. Radiation received varies inversely with the square of the distance from the source. This means that a missile launched twice the distance from a target, compared with another missile, would receive only one-quarter the amount of radiation.

An infrared detector will steer a missile towards the strongest radiation source within its sight. The sun is so massive that, although its maximum intensity is at 0.5 micron, its output at other wavelengths will generally overwhelm that of any other source. So care must be taken not to point the missile towards the sun. If the missile "sees" the sun for only a short time prior to launch, or "sees" only the area around the sun, any deleterious effect would probably be temporary. Pointing at the sun for a longer period than a single sweep may destroy the receiver's capability. Precautions against exposure to the sun for a missile are similar to those to protect the eyesight for humans watching an eclipse. For the same reason, background radiations which attract a missile should be avoided. These may be reflections of the sun on clouds, radiations from hot stacks or furnaces in industrial plants, or reflections and radiations from hot areas such as deserts in the summer. Such background effects may be especially critical if the missile is fired when the plane is in a dive.

To avoid guidance failures of IR systems, the equipment must operate as designed and employed within its design limitations. When any doubt exists — whether conditions or altitude — range to target should be reduced to the minimum practicable before launch. Irdomes when not in use must be protected by covers to prevent loss of transparency and to avoid cracking. The missile should be protected at all times from moisture which might reduce the receiver's sensitivity or cloud the irdome.

The incident rate will be reduced substantially if ground crews and aircraft commanders are aware of detection systems' limitations. Application of adequate care will help the missile operate as it should. ★

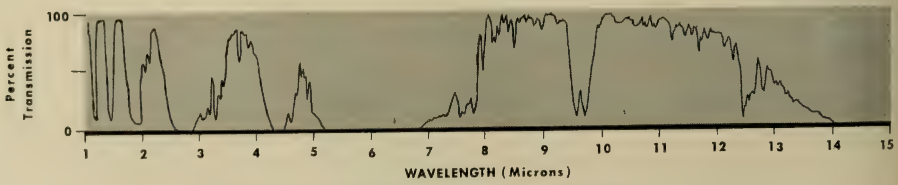


Fig. 3. **Transmission of Radiation Through Atmosphere**

Missilanea

DON'T KEEP IT TO YOURSELF – Although missile systems and technical data have been undergoing change and modification continually since their inception, almost daily we find additional improvement which is necessary to enhance safety and, therefore, reliability of the systems.

Many courses of action are open to us, such as the URs, AFTO 22s, Serious Hazard Reports, etc. All of them have played an important part in effecting improvements. Nevertheless, we often hear of conditions through field visits or even by word of mouth which affect the safety of personnel or equipment but which have not been reported.

The old axiom that "the squeaking wheel gets the most grease," is still true. But, beyond the fact that your squeaking or, more appropriately – yelling, will get a greater and probably quicker response, you'll be warning others of the problem which they may not yet have recognized.

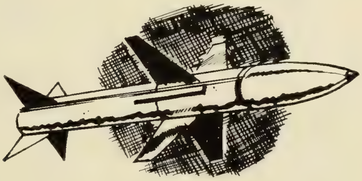
Major K. H. Hinchman
Directorate of Aerospace Safety

AMMONIA STRIKES AGAIN – The AGM-28 had been down loaded from a B-52 aircraft and hung on a storage rack. Final steps, which included the installation of all protective covers, were being taken to close the missile. An airman was attempting to install a dust cover on the disconnect ammonia valve when ammonia began to spray from the valve. The discharged ammonia struck him in the face. Crewmen, working with the airman, rushed to his aid and placed him under a deluge shower. Shortly thereafter, the airman was rushed to the hospital and treated for caustic burns to the left side of his face, forehead, lips and mouth – plus irritation to the respiratory tract.

Investigation revealed that the disconnect ammonia valve (PN 21372-21) was not fully locked. However, the ball check valve was closed sufficiently to retain the system ammonia but opened almost immediately when the dust cover made contact with the valve assembly.

It is recommended that all disconnect ammonia valves be visually inspected to ascertain that the ball check valve is in the closed position. Then – and only then – proceed with the dust cover installation or ammonia servicing operation.

Maj Edward D. Jenkins
Directorate of Aerospace Safety



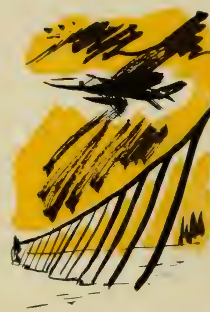
TO DIG A SPARROW'S GRAVE – Recently a unit experienced several "Dud" AIM-7 missile launches. The missiles were ejected from the AERO-7A launcher but the motors failed to fire. The missiles could not be recovered since they were fired on a water range. The aircraft was checked thoroughly and passed all the required electrical checks. This led to speculation as to cause factor. Many theories were advanced by the experts but since no positive answer was found, the AERO-7A launcher was sent to Raytheon for TDR.

The TDR revealed that the launcher had been reassembled, after maintenance, without the forward and aft accumulator plugs. During static pit ejection shot tests, it was noted that with the accumulator plugs removed, the missile would unlock and free fall from the launcher. The power gas for piston operation was exhausted through the forward and aft accumulator holes and the piston moved down about 1½ to 2 inches from preload spring tension. Full travel of the piston is required to actuate the motor fire switch (LSE1); therefore, under the above conditions, the missile would simply unlock from the launcher and free fall. This is not a bad maneuver if the "unfriendly" is directly below you.

TO 11L1-3-22-3, when followed, seems rather clear on the care and feeding of an AERO-7 launcher.

Maj Richard A. Brown
Directorate of Aerospace Safety

Aerobits



BARRIER discrepancies was the subject of a recent Operational Hazard Report. Conditions at the base where these discrepancies were noted were as follows:

- The approach end MA1A jet barrier webbing was in the down position, but the cables were not disconnected.
- The location of the anchor plates toward the edges on both sides were not spaced properly. This precludes proper vertical line-up of webbing and raises the cable from the runway surface. This problem can be resolved by installing additional anchor plates between existing plates to allow proper vertical line-up of the webbing.
- The MA1 cable on the approach end was kinked and would not lie flat o the runway surface.
- The BAK-6 cables were not properl pre-tensioned. Several large aircra (C-135 and C-124) were observed t operate across the approach end BAK- cable on takeoff. In one case, the cabl bounced an estimated 12 to 14 inche above the runway surface.

An inadvertent approach end engagement of the MA1A could result in a major accident.

Barriers are extremely useful and hav prevented many possibly serious acc dents (see "Barrier Success Rate," pag 27). It would be ironic if these fine a cident preventers were to be the cause a disaster.

ALTIMETER CORRECTION CARDS—Situation: Routine cross-country flight. Enroute: near miss with a civil airliner. Investigation: Pace flights showed fighter off by as much as 400 feet, civil airliner off another 250. At the flight level of occurrence, 1000-foot separation was the rule. Actually as little as 350 feet existed. Considering the separation and the element of surprise, it's no wonder somebody started hollering *NEAR MISS!*

Some aircraft have altimeter correction cards and some have not. Those that have, need them. Some of those that haven't, also need them. A program to provide accurate flight test data for these aircraft altimeter correction cards is under way.

The criterion for installation of cards is a total altimeter indicating system error in excess of plus or minus 250 feet. To correct this condition, common or fixed system errors are determined by flight tests and entered in the handbook and on the altimeter correction card.

You as a pilot may tend to think that a few hundred feet are not important. If you're the only aircraft up there, you're right. But, if you're not and you meet someone else with altimeter errors in the opposite direction, and that pilot shares your opinion, you'll wind up trying to share the same airspace! Crowded airspace with 1000-foot separation isn't too bad, but with no separation, it can become very exciting.

Check the T.O. list on your aircraft for the requirements of an altimeter correction card. If the T.O. says yes, and there's none in the aircraft, stay home! Don't make a planned mistake.

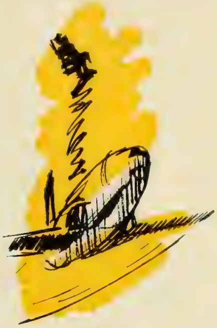
Lt Col Richard R. DeLong
Directorate of Aerospace Safety

PATTERN FLAMEOUT—GET OUT!—At the conclusion of a recent single engine flameout accident, the accident investigation board recommended that the Flight Safety Division publicize the accident circumstances, and that significant findings be brought to the attention of all fighter pilots.

After executing a go-around and establishing a normal downwind leg, the pilot of a Century Series fighter experienced a flameout. He announced the flameout to the tower and stated that he was making an airstart. Mobile Control advised him not to delay ejection too long. The pilot reported he couldn't get an airstart and was again advised to get out. He ejected at a very low altitude with a high rate of sink and received fatal injuries.

The board wanted to highlight the facts that multiple airstart attempts are not recommended when flameout occurs at traffic pattern altitude. Zoom should be used to trade airspeed for altitude, and pilot survival is the primary factor for consideration under these circumstances.

All of us in the Fighter Branch of Flight Safety agree wholeheartedly that it is unlikely, once the engine winds down, that there will be sufficient time to make the start and get enough power to start flying again prior to impact. When the engine flames out at 1500′ and airspeed is low, get out!



Lt Col Eugene P. Sonnenberg
Directorate of Aerospace Safety

STANDARDIZED! Many times malfunctions experienced by pilots cannot be handled "by the numbers." Situations occur where there is no "School Solution" and the pilot must handle the problem with the knowledge he has of his aircraft systems. While close adherence to, and emphasis on, procedures is quite necessary, it is a poor *substitute* for knowledge of the aircraft system.

- Aircraft was on a routine training mission, constant airspeed and RPM, when one engine RPM went to zero. Assuming a flameout, the pilots shut down the engine and completed a single engine landing. All other instrument indications were normal. Cause: (For zero RPM) tach generator shaft failure.
- Aircraft was in normal flight when one engine EGT began fluctuating from zero to 900 degrees. The engine was immediately shut down and a single engine landing accomplished. All other instruments: normal. Cause: malfunctioning EGT system.

Maj Jack R. Pulliam
Directorate of Aerospace Safety

BARRIER SUCCESS RATE. Figures on barrier engagements for the first nine months of 1965 reveal that hook arrestments, including pre-planned approach end arrests, have been very successful. Conversely, non-hook engagements (MA-1) leave much to be desired. Here's the box score.

Total Barrier Contacts	227	
Successful	209	
Unsuccessful	18	
Per cent successful		92%
Hook Engagements*	197	
Successful	194	
Unsuccessful	3	
Per cent successful		98%
Non-hook Engagements	30	
Successful	15	
Unsuccessful**	15	
Per cent successful		50%

* Pre-planned approach end 13 successful, 1 unsuccessful.

** Eight too slow speed for engagement.

Harrie D. Riley
Directorate of Aerospace Safety

Aerobits

WHERE'S THE STREAMER?—Another set of F-106 armament doors were damaged beyond economical repair because someone (not necessarily the crew chief) acted in haste. The pilot and crew chief were making the preflight, and after examining the armament configuration, the pilot told the crew chief to close the armament doors. The crew chief visually checked the bays, then closed the doors. A loud crashing noise was heard! Inspection revealed the left front door lock was still installed. No streamer was attached.

The crew chief was assessed personnel error for failing to remove all six locks before closing the doors. Current procedures were considered adequate so all personnel were rebriefed.

- Why didn't the pilot insure that the locks were removed prior to telling the crew chief to close the doors?
- Where did the streamer for the lock go?
- Current procedures were considered adequate (if followed) but were changed to provide for the doors to be closed except for loading, unloading or performing maintenance.

Suggest the F-102 and F-106 units survey their loading and preflight inspection procedures to determine whether their armament doors are in danger.

OVERSEAS LANDING AREAS. Increased flow of air traffic to overseas areas results in aircraft landing at airfields which do not meet minimum Air Force safety criteria. Adding to this potential hazard is an increase in the tempo of operations because of the urgency of mission requirements. Here is a case in point.

The aircraft arrived over the terminal and prepared for landing. Approach control couldn't be contacted and GCA was on standby. The result was a 25 minute delay. Two surveillance approaches were made without success. After finally getting lined up, the pilot was told that runway lights on the right side had just gone out. After a landing on the extreme left side, the pilot taxied into the parking area, where fuel was observed leaking from the left wing. Inspection disclosed a hole in the underside of a fuel cell and Nr 1 prop blades chipped. During the investigation it was learned that weapons carrier personnel had driven a truck without lights alongside the runway toward the POL area. The truck had stalled and was being loaded along the runway shoulder. Damage to the aircraft resulted from the left wing and Nr 1 propeller striking the truck during landing rollout.

Incidents involving congested ramps, lack of wing walkers, absence of adequate runway markings and lighting, ditches, obstructions near runways, vehicular traffic on the airfields and other hazards are becoming more frequent.

It is of utmost importance that all aircraft commanders on rotational assignments be alert to the above cited accident producing causes prevalent in overseas landing areas. ★

Directorate of Aerospace Safety
Harrie D. Riley

☆ U.S. GOVERNMENT PRINTING OFFICE 1966 201-213/5

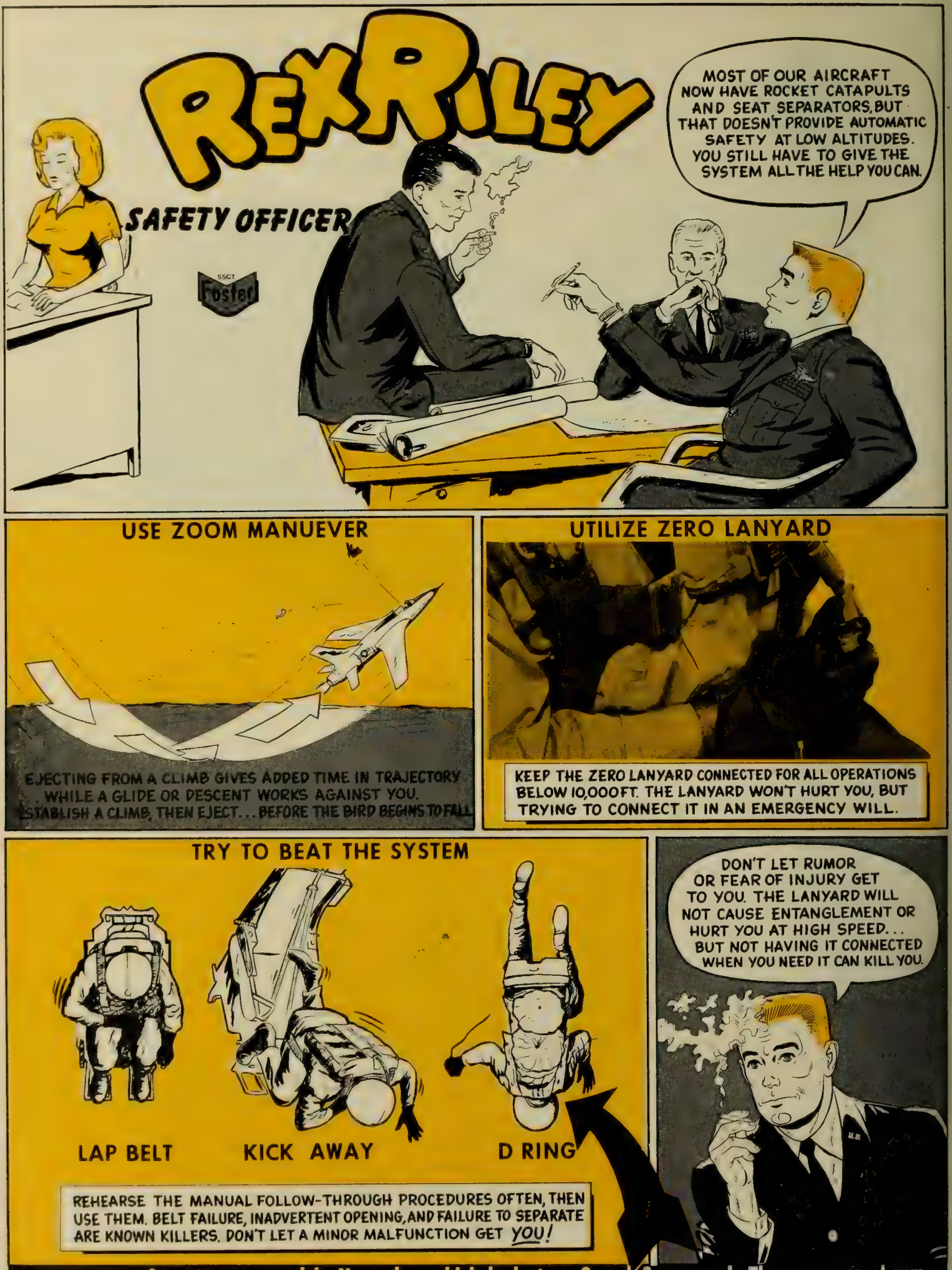
WELL DONE

CAPTAIN CHARLES E. SHELTON

15 TACTICAL RECONNAISSANCE SQUADRON, APO SAN FRANCISCO 96553

Captain Charles E. Shelton was accomplishing an annual instrument proficiency flight check in an RF-101A. After one hour and thirty minutes of flight, he lowered the landing gear for an instrument approach. The right main gear and the nose gear extended normally, but the left main gear remained in the up position. Captain Shelton used all emergency gear extension procedures but the results were negative. Knowing that a landing with one main gear retracted would cause a loss of directional control after touchdown, Captain Shelton elected to place the aircraft in a main gear up and nose gear down configuration. This would allow touchdown on the two empty drop tanks and the extended nose gear. This particular gear configuration required increasing airspeed to exert high airload pressures on the nose gear assembly to prevent its retraction, while at the same time placing the gear handle in the up position to retract the right main gear. Once this was accomplished, the gear circuit breaker was pulled and the gear handle was returned to the down position. This procedure gave the desired gear configuration for landing. With adequate time to prepare for a gear up landing, firemen laid a 3500-foot foam strip on the runway. A normal final approach at 170 knots was flown and touchdown was made on the empty drop tanks and nose gear. The aircraft slid to a stop in 3200 feet and sustained only minor damage to the wing flaps. A total of 31 manhours was required to repair the aircraft and return it to flying status.

Captain Shelton's intimate knowledge of the RF-101 aircraft and his demonstration of outstanding airmanship enabled him to minimize the seriousness of this mishap and prevent what might otherwise have resulted in a major aircraft accident and personal injury. WELL DONE! ★


REX RILEY
SAFETY OFFICER
SSGT Foster
MOST OF OUR AIRCRAFT NOW HAVE ROCKET CATAPULTS AND SEAT SEPARATORS, BUT THAT DOESN'T PROVIDE AUTOMATIC SAFETY AT LOW ALTITUDES. YOU STILL HAVE TO GIVE THE SYSTEM ALL THE HELP YOU CAN.
USE ZOOM MANUEVER
EJECTING FROM A CLIMB GIVES ADDED TIME IN TRAJECTORY . . . WHILE A GLIDE OR DESCENT WORKS AGAINST YOU. ESTABLISH A CLIMB, THEN EJECT . . . BEFORE THE BIRD BEGINS TO FALL
UTILIZE ZERO LANYARD
KEEP THE ZERO LANYARD CONNECTED FOR ALL OPERATIONS BELOW 10,000 FT. THE LANYARD WON'T HURT YOU, BUT TRYING TO CONNECT IT IN AN EMERGENCY WILL.
TRY TO BEAT THE SYSTEM
LAP BELT
KICK AWAY
D RING
REHEARSE THE MANUAL FOLLOW-THROUGH PROCEDURES OFTEN, THEN USE THEM. BELT FAILURE, INADVERTENT OPENING, AND FAILURE TO SEPARATE ARE KNOWN KILLERS. DON'T LET A MINOR MALFUNCTION GET YOU!
DON'T LET RUMOR OR FEAR OF INJURY GET TO YOU. THE LANYARD WILL NOT CAUSE ENTANGLEMENT OR HURT YOU AT HIGH SPEED . . . BUT NOT HAVING IT CONNECTED WHEN YOU NEED IT CAN KILL YOU.

NOTE: A poster appeared in November which had steps 2 and 3 reversed. The sequence shown here is the correct one. "Beat the system" *does not* apply to aircraft utilizing the seat with integrated harness. Applicable dash one procedures will apply in this case.

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FLYS

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SAFETY

UNITED STATES AIR FORCE

MARCH 1966

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FALLOUT

TAME THE TIGER

In order to keep Aerospace Safety the fine magazine it is, I wish to point out the error in the article "How We Tamed The Tiger in Our Transmitter," by Mr. Scott. (Dec. 1965).

On page 17, Fig. 2 appears the inside view of an MRN-8A Glide Slope and not a VOR.

By close examination of the men in Fig 2 you will note the man making the adjustments wearing a ring and a watch, plus he has both hands on the equipment which is taboo.

The article by Mr. Scott is a very fine one and brings to light how safety-minded we are in AFCS.

TSgt Wayne A. Hagan, USAF
NAVAIDS Maint Supvr
Moron AB, Spain

C-119 PREDICAMENT?

Wonder how many C-119 drivers have been faced with the dilemma of having to use reverse thrust in taxiing or let the aircraft set overnight awaiting a tow bar? Probably not many, since, after having given this matter due consideration, you promptly decided to deliver the troops today instead of tomorrow. But, have you checked the Dash One lately? In the paragraph titled CAUTION it states:

"Ground maneuvering of the aircraft utilizing reverse thrust will be used in emergencies only."

Now I'm sure all C-119 pilots feel that you can back this aircraft safely, but let's examine this practice. First, you are violating the intent of this CAUTION note in all except bona fide emergencies. (Remember the F.E.B. is going to decide whether or not what caused you to maneuver with reverse thrust was an emergency.) Secondly, you are accepting the responsibility for the successful completion of this unauthorized procedure, and airplanes haven't become any cheaper these days. Finally, most of us will agree that it is not a simple feat to perform in this aircraft and, let's face it, the CAUTION is well taken.

So what can we do? Let the aircraft stay put? Yes. This is the answer most often suggested by our supervisors, but certainly it is not always practicable. Then we come to what constitutes an emergency. Certainly the request of the Yellow Truck boys does not fall in this category.

Our suggestion that the only practical method of helping us in our predicament is to present our limitation to Transit Alert and advise them that, except under conditions which would effect loss of life or aircraft, we cannot maneuver the C-119 utilizing reverse thrust.

Maj Paul D. Jewell, AFRes
Safety Officer
Hq 945 TCGp (CONAC)
Hill AFB, Utah 84401

SEE-THRU CIGARETTE LIGHTER

Reference is made to the answer to the letter in Fallout (November issue) entitled "See-Thru Cigarette Lighters."

What is a fighter pilot doing lighting cigarettes? (Reference AFR 60-16, par 20 h.)

Maj John F. Nortness
Physiological Training Officer
APO New York 09220

In flight, he shouldn't.

YOUR KNOWS

In today's modern age of exotic fuels and oils, sophisticated weapon systems, automated flight control systems, space walks and Gemini rendezvous, the time seems right for a reminder that none of these advancements has fully supplanted man and his senses of *smell, sight,* and *feel.* (The order of importance is irrelevant at this time.) Here are a few examples of everyday occurrences dealing with the sense of smell that may convince you the nose knows.

While a missile was on alert status, the launch control officer noted an ammeter driving into the red. He immediately dispatched a crew to the launch bay to investigate. Upon arrival the crew smelled an odd odor and investigated immediately. They found the nose section (missile nose, that is) to be hot to the touch; they suspected failure of the torque exciter so the missile hold power was turned off. Maintenance personnel later discovered that the torque exciter motor bearing was dry of lubrication and had frozen to the shaft, causing the motor to overheat and the torque exciter cable harness to melt in spots.

One day last summer, after about an hour of flight, a fighter pilot began to feel a big woozy and decided to check his oxygen connections while he was still able. He checked. Everything seemed all right but he wasn't satisfied, so he removed his mask. Then he could smell the fumes in the cockpit. They were not strong enough to cause his eyes to burn or to make him bleary-eyed, but he decided to go to 100 per cent anyway. He did, and landed his aircraft without a hitch. There was a hydraulic leak in the engine intake, which was corrected and the F-100 was soon ready to fly again.

Another fighter pilot, while making a low approach following an ADF penetration, noticed heavy smoke and smelled electrical fire fumes in the cockpit. The pilot declared an emergency, switched to ram air, and went to 100 per cent oxygen. The cockpit cleared of smoke, and a straight-in landing was made. Even though the light was not on, the pilot suspected failure of the main inverter; but, since the aircraft was so close to the runway he didn't switch to the alternate inverter until after touchdown. His hunch was confirmed by the ground crew. The inverter had just been installed – replacing another main inverter that had failed because of overheated bearings.

The next one happened on a cold day in January. Shortly after takeoff this fighter pilot smelled a slight odor of oil fumes in the cockpit. He reduced power to 85 per cent, and continued his climb. The oil fumes dissipated as power was reduced. Power was re-applied and increased to 95 per cent for a climb to 20,000. The fumes recurred. The pilot attempted full throttle but received only 94 per cent power and decided to enter a precautionary landing pattern from an 8000-foot high key point, at 80 per cent. Command post advised maintaining power at or above 80 per cent, going to 100 per cent oxygen, and dumping cabin pressure. On base leg the pilot realized he was high and hot (3000 ft and 240 KIAS) and decided to go around after turning final. Power was applied and a drop in oil pressure, with fluctuations from 25 to 10 psi, finally stabilized at 20 psi. A normal landing was made; after the engine was shut down, large globs of oil were observed on the left side of the fuselage. Investigation disclosed complete loss of engine oil caused by the failure of the duplex bearing oil supply tube.

Fumes detection is not limited to fighter pilots; the transport people have good noses too. Take the transport that was on a transition flight for about an hour or so when its pilot initiated an ADF circling approach. On base leg the flight engineer reported he could smell fuel fumes. The control tower was notified and electrical sources were shut down. A normal landing was made and all engines shut down as soon as the aircraft turned off the active. The crew evacuated the aircraft; by now the fumes were extremely heavy. Fuel was observed coming from every seam in the underside of the fuselage, almost the entire length of the transport. Three faulty components of the fuel system had precipitated this hazardous condition. Fortunately, the right people with the right repair equipment were on hand and soon put this airplane back in commission.

The next item was borrowed from the Flight Safety Foundation bulletin and it could be a "one-of-a-kind" story, except that there are many persons in the Air Force who enjoy hunting and fishing, and with a number of sportsmen around, this incident *could* happen again.

A crew entered the aircraft and immediately experienced sudden air hunger and hyperventilation. Investigation revealed a container of fresh game packed in dry ice that had been left aboard the aircraft all night. Sufficient dry ice had sublimated to high levels of gaseous CO_2 to cause the symptoms. If aircrews are going to fly fresh game or any other materials packed in dry ice, they should make sure that adequate ventilation is provided to prevent CO_2 buildup beyond the permissible level of 5000 ppm; also, aircrews should be aware of symptoms resulting from high-level CO_2 exposure. Don't let your kill turn the table on you.

Smell well! ★

THE BELL RANG ON and ON

Maj Henry K. Good, Chief of Safety, 9 Wea Recon Gp, AWS, McClellan AFB, Calif.

Ah, come on, fellows — you know the bell I'm talking about. It's the one that you "hear", only subconsciously. The one that says, "Hey, Buddy, you're about to get in trouble."

This particular bell just about wore itself out on two friends of mine. They both had more than 2000 hours, had been flying for many years with spotless records and they knew the rules well.

They had finally pried a cross-country bird out of scheduling and had a beautiful trip planned. Lots of flying time combined with two RON's at choice locations. The big day arrived. As they approached their bird, an airman was removing something from the nose section. "Something" was the VOR; it was inoperative and there were no replacement units on base (R-i-n-g-g). After a discussion, my friends decided to press on and use the ADF as the primary navigation aid — after all the weather was forecast to be VFR over the entire route (R-i-n-g-g). "What about those thunderstorms enroute?" "No sweat, they're isolated." (R-i-n-g-g . . . no answer.)

While taxiing out for takeoff the UHF started to cut out (R-i-n-g-g). My cross-country fixated friends discussed this as they taxied. Suddenly the UHF cleared up. "Must have been in a blind spot." "Yep, must have been." (R-i-n-g-g.)

The first leg of the flight was routine, we-l-l-l, almost routine. The “bird dog” seemed to be quite erratic, but that was probably due to the heavy static and the numerous thunderstorms (R-i-n-g-g). However, GCI did a beautiful job of vectoring them around the “isolated CB’s.” The next leg had fewer thunderstorms, but seemed to have a series of weak radio beacons (R-i-n-g-g). However, it’s hard to miss New Orleans (the next turn point) when you head generally south from Memphis – big river, big lake, big city, all located in the vicinity (like the north shore) of a lot of salt water normally referred to as the Gulf of Mexico. A 90-degree right turn followed by some unerring pilotage soon took my friends to the next JP-4 filling station.

The pitch out and landing were marred only by a 1000-foot error in altimeter interpretation which did make for a rather high pattern and a sporty final. The ADF seemed better, particularly after landing. Besides it was after 1700 and would probably wind up “ground checked okay” anyway (R-i-n-g-g). The next leg was an easy one, only an hour thirty and after all, “. . . who could miss Albuquerque on a nice clear night? Just stay south of Route 66 and head for the bright lights when the ETA runs out.”

The bell didn’t ring that time, it was out of breath or whatever it is that bells run out of. The UHF started cutting in and out again during taxiing, (R-i-n-g-g) but cleared before takeoff. The ADF encountered more weak beacons and the adventurers relied more and more on the good, old gyro stabilized compass and pilotage. At ETA there were no lights to be seen except way up to the north. An attempt was made to call Albuquerque tower, but the UHF garbled and cut out. After they had flown for 12 to 13 minutes, the lights proved to be Albuquerque and the tower boomed in loud and clear. Our heroes decided that they had picked up a whooping crosswind, unforecast of course, made a few pointed remarks about the weather people and landed. They wrote up the ADF, “ADF seems weak” (the only thing weaker than the ADF was the write-up). They didn’t write up the UHF since it had worked like a charm during the last few minutes of flight, on landing roll and even in the parking spot (R-i-n-g).

The radio maintenance technician read the comment and proceeded to check the ADF. He tuned in the local beacon, checked all positions; they all worked correctly and the signal was fairly strong. It shouldn’t surprise you to hear that he signed the ADF off as “ground checked O.K.”

The next day our heroes made a few disparaging remarks about Transient Maintenance, but made no attempt to find out what had been done and why. Takeoff was a little hairy due to a slight miscalculation of takeoff distance, a rough runway and some over-anxious back pressure on the stick. It is a tribute to the designers that the bird finally defeated gravity and the back side of the power curve, but only after scorching sage brush for a few miles. The takeoff so unhinged the troop in the back seat that he forgot to give the ADF a good check during climbout (R-i-n-g). “No sweat, I can check it on Winslow in a little while. No need to track outbound anyway (R-i-n-g-g-g-g).” The time came to tune Winslow – certainly was weak –couldn’t identify it for sure due to heavy static and weak signal (R-i-n-g). The ADF needle swung in a slow, never-ceasing circle except when it hesitated momentarily to point out one of the larger “isolated” thunderstorms (R-i-n-g – Hey, fellows, come on, let’s go back!). The forecast lower broken deck changed to a solid, sullen undercast and the thunderstorms grew like mushrooms. The tops that had been forecast for 30,000 were soon reaching 40,000 (R-i-n-g).

The bell rang again and again. Finally our erring eagles heard and heeded. The change was startling – once again they were professionals. They called GCI, but now the UHF was wearing the black hat – it garbled and cut in and out. Some agonizingly broken transmissions followed. One came through intact. They were informed that their IFF wasn’t operating, but a tentative fix placed them south-south-east of Tucson (’way south), and then came the blow, “AF Jet 12345, this is Code Name, our weapon is bent – garble – static –.”

By this time our two freely perspiring eagles were at 40,000 feet circumnavigating the almost continuous “isolated” thunderstorms. The UHF, ADF and IFF were all inoperative and the VOR was on somebody’s workbench a thousand miles away. The long overdue 180-degree was made and much time passed. Shortly after they switched to the fuselage tank a hole appeared in the undercast; through the hole, a river and a town! Throttle to idle, roll over and down, down. Oops, ailerons are buzzing, speed boards, down, suddenly they broke out. The town – Las Cruces – turn direct to El Paso – the low fuel warning light had been on for an eternity. They tried to call tower on both normal and Guard – no luck – pick a runway, pitch out, turn final and the light dawns. The gyro compass is a steady 60° off runway heading; the standby, as usual a little undecided, averages about 20° degrees off runway heading.

Our two aviators wrote up the ADF, the UHF, the IFF and both compasses. IN DETAIL. They checked into the BOQ, showered, dressed and headed for the club. After spilling everything but the olives in their first pair of “Juniper Delights” they followed the bartender’s suggestion and used both hands, not very delicate but highly effective. This was the second effective thing that they had done on the entire expedition. The first, when they finally wrote up their bird and all of its shortcomings.

They discussed the entire trip and decided that their airmanship had not been quite sterling. The logical conclusion to a series of flights such as theirs was a punch out or a rapid deceleration in a stuffed cloud. As they munched olives they summed up the reasons for their actions.

- Cross-country T-Birds were few and far between.
- The waiting list was long.
- There was no spare aircraft and it was doubtful that radio maintenance could have fixed their bird that first afternoon.
- If they hadn’t departed on the scheduled day they probably would have lost the bird to a priority mission.
- They both needed the time.

These reasons almost cost the USAF an expensive piece of hardware and possibly a pilot or two. Tell me, readers, do any of these reasons sound familiar to you? ★

IFO

*Identified Falling Objects

Generally everything attached to an aircraft has a purpose for being there. External items include doors and panels of various size, shape and location that provide protection, access and streamlining. The functions of external tanks, pylons and similar hardware are obvious.

In the vernacular then, there are reasons for all that garbage. It follows, therefore, that the loss of any of these items not only constitutes a hazard on the ground, but possibly more serious hazards to the aircraft itself and, of course, the aircrew.

A recent message indicated that a unit was very concerned over the loss of three external tanks in two years. Looking at this from another angle, three such losses over that period of time doesn't seem like very many. But multiply this by the number of such units in the Air Force and by the number of items that can come off an aircraft in flight. The problem now reaches very serious proportions.

Listed below are a few occurrences representative of the kind that happen every day.

F-105. During a functional check flight at 14,000 feet and 420 KCAS, the left 450-gallon drop tank separated from the aircraft at the pylon connection.

Cause unknown.

F-102. During a climbing turn at 6000 feet, the right external tank and pylon assembly left the aircraft causing damage to the wing.

Cause undetermined, but design deficiency suspected because overcenter locking mechanism can be properly torqued when the unit is resting on dead center, which would be hard to visually detect. This is not a new problem and AFLC is working on a fix.

C-130. Aircraft was on autopilot, 190 KIAS, FL240, clear weather when buffet was felt. Pilot suspected life raft release, which was the case. The departing raft damaged both horizontal stabilizers and one elevator and trim tab.

Suspect trapped air in right inboard raft expanded at altitude enough to open the access door and allow raft to escape.

T-33. Pilot returning from low level target mission was surprised on return to base to find that the travel pod was missing.

Suspect retaining pins failed or slipped out.

KC-135. Postflight inspection revealed portion of keel beam equipment bay door missing. Crew had not been aware of anything amiss.

Probable cause was considered to be either failure of latches or failure to secure airlock fasteners.

CH-3C. This chopper was on a search mission when a cargo compartment window was lost.

Cause was thought to be temperature change of plexiglas, which caused warping, and deterioration or rubber seals due to oil spillage or leakage from main rotor head and gear box.

T-33. Imagine the pilot's surprise when he arrived at destination and found that the clothing he had placed in the travel pod was gone because the pod door fell off. Weather during the flight had been VFR with only a short period of light CAT.

Cause undetermined. One door latch was torn off and the other appeared to have come unfastened.

B-58. Tanker boom operator noticed that a panel was missing from leading edge of B-58. Screwheads remaining on aircraft indicated they had been pulled through.

Suspected cause was that sealant on panel had not adequately set and that panel subsequently was ripped off by slipstream.

C-130. While the crew was performing inflight gear checks, the right hand nose gear well door separated.

Since the door had been operated successfully many times in flight and while the aircraft was on jacks, materiel failure was assumed to be the cause.

B-66. At FL250 crew heard an unusual noise but could not determine the source. After descent to 9000 feet, the cockpit was de-pressurized and a check revealed the entrance door open about three inches. When the engineer attempted to close and lock the door, it separated from the aircraft.

Cause: Retracting mechanism pin and supporting bracket retaining screws backed off the nut plate, were elongated by wear and separated from the aircraft.

C-130. Two para-bundles weighing 450 pounds each were released on final approach to the drop zone.

Bundles were tied down on roller conveyors so that rear bundle provided restraint for forward bundle. When rear bundle was untied in preparation for the drop no aft restraint was provided for either bundle. Loadmaster's attention was diverted which prevented him from providing restraint to forward bundle. Light turbulence and nose high attitude of the aircraft caused bundles to roll out the cargo ramp.

Unfortunately, the reason for many of these inadvertent drops is never positively identified. Usually, in fact, the cause is listed as undetermined, most probable, or suspected.

Fortunately, we drop very few items into heavily populated areas. This does not mean, however, that the problem isn't serious. There are also the aircraft and crew to consider as well as completion of the mission.

Whether design, maintenance or crew is to blame, the deficiencies leading to loss of objects in flight must be identified and corrected as early as possible in order to prevent the occasional accident that inevitably accompanies numerous like incidents. ★

THE LAST 1000 FEET

Lt. Col. Jerry Creedon, AWS Liaison Officer, Directorate of Aerospace Safety

Weather in one form or another continues to be a major factor in many aircraft accidents. But a lot of pilots might be surprised to know that wind at or near the surface contributes to more aircraft mishaps than any other weather element (lightning/electrostatic discharges excepted.) Over the past seven years surface wind has been a factor in the damage of 212 USAF aircraft. We recognize that most of these were incidents by definition, not accidents, but the large number of mishaps should cause each pilot to pause and reconsider his crosswind landing technique. We also recognize that certain aircraft are more susceptible to crosswinds than others. Nevertheless, few aircraft types are members of the exclusive "it's never happened" club.

For light aircraft the problem generally is one of overconfidence and not "flying" the aircraft to a complete stop. As Orville told his brother, "Don't fill out the form one until after the flight." As a rule it seems that light plane pilots are quite concerned about flying if excessive crosswinds are existing or forecast but most of their mishaps occur well within the Dash One maximum allowable crosswind.

In larger and heavier aircraft frequently there are one or more other factors present, which in hindsight at least, should have alerted the aircrew. Low ceilings, poor visibility, icy runways or wet runways certainly increase the probability of an accident. Drag chute deployments, where required, further enhance the problem. Incidentally, there have been several incidents this winter wherein drag chutes have failed to deploy or failed to blossom because the chute was packed wet. We doubt if anyone has figured out the retardant effect of a block of ice, but it undoubtedly is much less than a fully deployed drag chute.

Then there apparently is a problem of correctly reading Dash One crosswind component charts. The maximum gust reported is used to compute the component. Be concerned about the steady speed and gust speed spread. A large spread within the recommended zone can be more of a problem than small gusts right on the limit line.

Let's consider for a moment true wind and magnetic wind. In briefings, all weather stations issue magnetic wind concerning the local base. This is fine, just what you want, since the runway direction is referred to in magnetic direction. All landing control agencies also issue magnetic winds. All winds transmitted on teletype circuits are TRUE winds. Also, *all* forecast winds are issued in TRUE directions. TRUE wind is entered on the DD-175-1 for destination. If surface wind may be a problem at your destination you can't compute the component until you check the variation and convert the wind to true.

It should be noted that wind measurement equipment on USAF bases is standard. Anemometers are installed on a 13-foot high post adjacent to the runway and at approximately the touchdown point. Most airfields have dual installations (one at each end of the instrumented runway); however, some fields have only one anemometer installed adjacent to the midpoint of the runway. All agencies providing wind information for the base (weather, tower, RAPCON, etc.) have readouts for the anemometer in use for the currently active runway.

Since landing short is not an unheard of problem, let's review the effect of changing wind on final approach. For years pilots have known that winds tend to decrease in velocity near the ground. Studies indicate that the greatest changes in wind velocity occur between 300 feet and the ground and wind direction remains fairly constant below the 300-foot level. (Handbook of Geophysics, AFSC, USAF). Headwind gradient effects normally benefit an airplane during takeoff, because, as the airplane climbs into increasing wind velocity, the indicated airspeed increases faster than the airplane accelerates over the ground. Just the opposite occurs on landing. A strong headwind that decreases as the airplane nears the ground can cause a decrease in indicated airspeed, resulting in a lower speed over stall. Unless the deceleration is compensated for the aircraft will sink below the glide slope and land short. Bear in mind, terrain features may amplify the changing wind speed. Figure 1

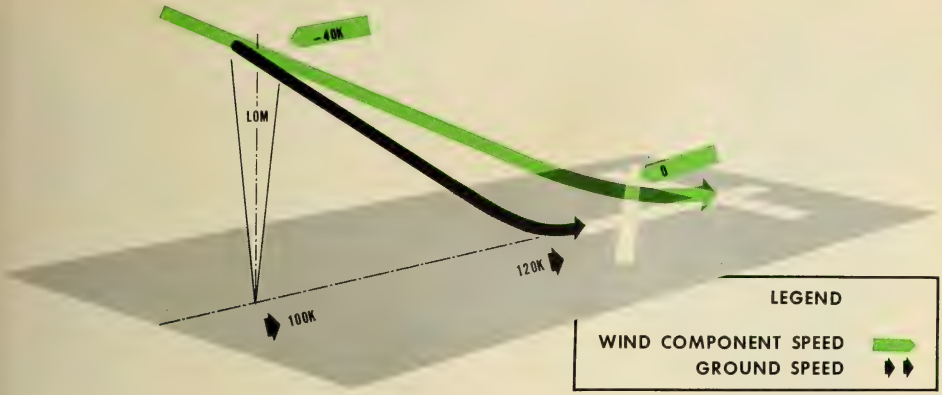


Fig. 1

clearly illustrates the problem. (Airspeed over the marker is 140KIAS with a 40K headwind. Groundspeed is 100K. When the wind decreases to zero rapidly the airspeed may decrease below the 120K approach speed.)

Now let's examine what happens when we have a tailwind at outer-marker or traffic pattern altitude with a zero surface wind (Figure 2). In this case the airplane must reduce not only to proper approach speed (120K), but must decelerate an amount equivalent to the speed of the tailwind (40K) prior to touchdown. The alternative is either overshoot or higher airspeed. The root of the problem is this: Whenever the wind environment changes faster than the aircraft mass can be accelerated or decelerated, the wind variations must be reflected by changes in airspeed.

Shear can be anticipated whenever there is an inversion. Shear is also a hazard potential with frontal passage and in and near thunderstorms. Severe down drafts associated with thunderstorms warrant delaying takeoff or landing when such storms are over or adjacent to the airfield. Shear should be anticipated when taking off or landing over cliffs, water, in hilly terrain and with large buildings or trees adjacent to the runway. Normally, the severity of such low altitude wind shear bears a direct relationship to the surface wind speed. Don't overlook the help you can obtain from the weather forecaster. Check with him before takeoff and, when you suspect shear, call him before making your final approach.

Apply wind shear hazard planning for the aircraft you fly. When you have strong surface headwinds reported aim a bit farther down the runway. Ground speed will be less and roll out distance will be shortened. If shear is probable, a rather flat approach should be considered in order to transition the shear area more slowly and allow more time for correction. If taking off into suspected shear, accelerate as rapidly as conditions permit until safely above stall speed.

It is no news that most of our accidents occur in the landing phase of flight. Perhaps some of the points brought out will help toward more professional flight planning and flight. ★

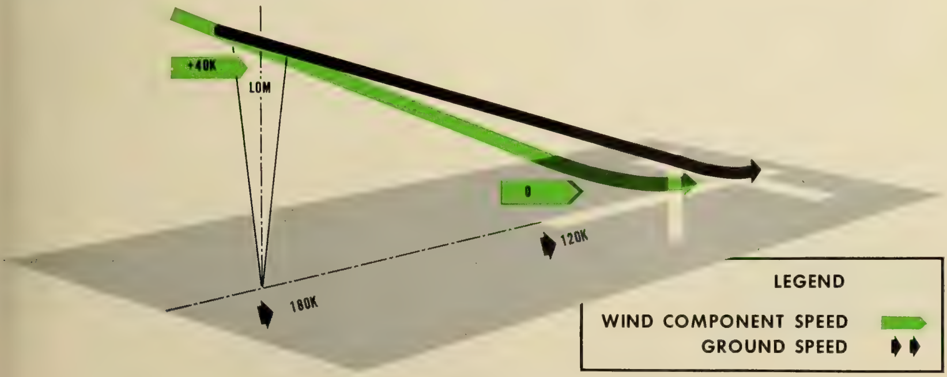


Fig. 2

Flying Status Insurance

Maj Kenneth H. Cooper, MC, USAF, Chief, Aerospace Medical Lab. (Clinical), Lackland AFB, Tex

Doctor Cooper is a specialist in aerospace medicine assigned to the Wilford Hall USAF Hospital, Lackland AFB. He is currently engaged in research documenting the role of physical fitness in maximizing aircrew responses to flight and space operations. The program he describes is designed for aircrew members and is supplemental to the officially required 5BX exercise program. The recommendations by Dr. Cooper represent his own views and are not necessarily the official position of the Surgeon General, USAF.

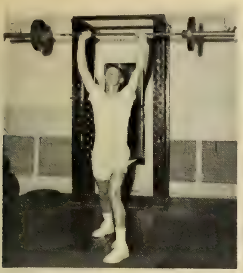
Annually, many more flying personnel are lost from the development of medical conditions incompatible with flying than are lost from aircraft accidents. This fact can be explained partially on the basis of better and earlier diagnostic capabilities. However, it is no longer a rarity to discover in a young airman a disqualifying medical abnormality that is usually associated with ageing. Heart disease, high blood pressure, stomach ulcers, and diabetes are only a few examples. Possibly, these conditions could be prevented or their onset delayed if the aviator had only practiced a little *preventive medicine*. The purpose of this article is to discuss some of these disqualifying medical defects and to suggest methods of preventing or delaying their onset. Perhaps, this information will help the airman improve his chances of being a career aviator.

THE PROBLEM

Heart disease and diseases of the blood vessels are the major offenders. When an airman suffers a heart attack, there is no question about his permanent removal from flying status. However, he may be completely without symptoms but have an abnormal electrocardiogram which is noticed incidentally during his annual flying physical. Finding this condition will lead to grounding just as rapidly as the well-documented heart attack. High blood pressure requiring medication is another medical problem that will produce grounding action. Stomach ulcers and diabetes also disqualify the airman but they do not approach the magnitude of the problems of heart and blood vessel diseases.

Before prevention or treatment of these medical offenders can be discussed, some of their possible causes must be identified. Heredity, stress, smoking, high caloric high saturated fat diets, and inactivity all deserve important consideration. Heredity and stress are examples of causes that are difficult or impossible to control. However, other controls which are possible should be practiced.

Cigarette smoking is an excellent example of a controllable cause. Studies have shown repeatedly that the one and a half to two packs a day cigarette smoker has at least three times more likelihood of developing a heart condition than the nonsmoker, cigar or pipe smoker, and even the former cigarette smoker. (Nicotine seems to have a toxic effect upon the heart that lasts very briefly, once the source is removed.)



Activities shown, left to right, illustrate kinds of exercises: Weight lifting, isotonic; pressure against immovable object, isometric; swimming, aerobic; long distance bike riding, aerobic.

Dietary control is also a distinct possibility, and it is important to control both the amount and the type of food consumed. A high calorie diet eventually leads to obesity which, in turn, increases the likelihood of developing many of the previously mentioned medical conditions. Even the thin individual becomes more susceptible to heart disease if his moderately low calorie diet is high in saturated fats (animal fats and dairy products primarily).

An inactive, sedentary way of life exists as another possible cause or complicating factor of many medical problems. For years it has been apparent that physically active groups of people do not experience a problem with heart disease. Of interest also is the discovery that physically active people may not be troubled with heart disease, even though they are heavy smokers and live on a diet high in saturated fats.

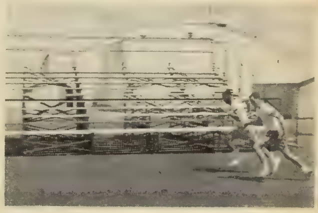
Regular physical activity seems to have a neutralizing effect on several of these harmful habits, and may even play a role in reducing the chronic effects of stress. The most dangerous combination of factors for developing heart disease consists of moderate obesity, a high saturated fat diet, a moderate amount of stress, and a completely sedentary life. If smoking two packs of cigarettes per day and a positive family history of heart disease are added, the chances of such an aviator completing 20 years on flying status are slim.

PHYSICAL FITNESS

Now that the value of exercise and physical fitness has been emphasized, it is advisable to define the term "physical fitness." It may mean merely freedom from disease or it may be a measure of physical strength. The definition proposed here, however, is endurance capacity, working capacity, or essentially the ability for prolonged work. This definition is restricted because scientific experiments have shown that a high endurance capability is most compatible with an efficient heart, lung, and blood vessel system. The body that is well trained to tolerate endurance stresses is best prepared to tolerate the emotional and physical stresses of the normal environment. For example, in an endurance trained subject the resting heart rate is very slow. However, during vigorous work, it has an enormous capability to perform and easily meets the demands of unusual environmental stresses. Even the lungs work more efficiently in endurance trained subjects. The capacity to breathe rapidly and deeply increases significantly. In general, the body seems to function more efficiently in response to endurance training. In contrast, exercises that tax the body only briefly do not produce the desirable effect of endurance training. Exercise for short periods may produce changes in muscle strength but do little for the heart and the circulation. Endurance training seems to be the most effective means of producing cardiovascular fitness. Therefore, the term "physical fitness" is restricted in this article to mean only endurance or working capacity.

PHYSICAL FITNESS TESTING

Endurance capacity or physical fitness, as defined here, is easy to assess. It can be determined by what is called a 12-minute walk-run test. A track, a straight stretch of road, or any other suitable course that can be easily measured is used for this test. The person starts and attempts to cover the longest distance possible in exactly 12 minutes by running preferably, but



Pushups represent an isotonic exercise; running in place, aerobic if continued for longer than six minutes; long distance walking, aerobic; sprinting, anaerobic.

walking when necesssary. The fitness classification is based on the distance covered, as follows:

Distance	Fitness Classification
1.75 miles or more	Excellent
1.40 miles to 1.74 miles	Good
1.15 miles to 1.39 miles	Fair
Less than 1.15 miles	Poor

If a person's performance places him in one of the lower two categories, he should not feel discouraged, for approximately 75 per cent of his contemporaries are there, too!

EXERCISE PROGRAMS

After a test of endurance capacity, usually the need for exercise is readily apparent. However, exercises can be grouped into at least four different categories (Isometric, Isotonic or Isophasic, Anaerobic, and Aerobic). Before selecting one of these exercises, it is desirable to become familiar with their characteristics.

Isometric. Isometrics are the famous exercises that contract muscles without moving anything, i.e., the 60-second-a-day type of workout. These exercises will improve muscle tone and, perhaps, strength, but only for doing isometric exercises with little, if any, heart and lung benefit. Isometrics also tighten and shorten ligaments that support joints and make them more susceptible to injury. In general, appreciable changes in a physical fitness level will not be observed with isometric exercises.

Isotonic or Isophasic. These exercises contract muscles but also flex and extend extremities. Weight lifting, calisthenics, and others belong in this category. These exercises are more beneficial than isometrics but still lack the capacity to produce all the changes desired in a cardiovascular fitness conditioning program. It is possible to become "over-muscled" as well as "over-fat" and the heart suffers in either situation.

Anaerobic. Anaerobic exercises constitute a step in the proper direction. Exercises which require submaximal to maximal effort for periods of less than 3 or 4 minutes are termed anaerobic exercises. With such short sustained exercise, the body does not have time to attain a "steady state" or a "leveling off point." These exercises include running for 1 to 2 minutes or isotonic exercises for brief periods and interspersed with frequent rest periods. Dash events in performance sports are classified as anaerobic exercises. Anaerobic exercises produce an adaptation at a lower level than aerobic exercises because the body attempts to adjust to the degree of stress imposed. For this reason, anaerobic exercises are useful but aerobic ones are better.

Aerobic. Exercises that require continual submaximal to maximal effort for periods of more than 4 minutes are aerobic exercises. Running, fast walking, swimming, cycling, rowing and cross country skiing fit this category. Evaluation of athletes so trained has shown that their body reaches a cardiovascular fitness level that far surpasses athletes trained with other types of exercises. It is also unusual for an athlete so trained to have a heart attack, high blood pressure, or any of the medical problems mentioned previously. If the maximum benefit is to be derived from conditioning, an endurance program should be followed.

A SIMPLE AEROBIC TRAINING PROGRAM

Once the value of an aerobic or endurance training program is recognized, the next question is how to institute such a program. The watchwords are: cautiously but progressively. More specifically, one of the aerobic exercises mentioned previously should be used. The simplest are walking, running, swimming, and cycling. In setting up a program, it is essential to assign each exercise a specific point value. By determining the energy expended in performing a certain exercise, the following scale is developed:

Exercise	Point Value
Running 1 mile in 7-9 minutes	5
Walking 1 mile at a 3.75 MPH speed	2
Cycling 1 mile at a 10-13 MPH rate	1
Swimming at a 75-90 feet per minute rate	1 point per minute

Using this scale, the subject may select one exercise or a combination of several. Very slowly and comfortably, he enters into the program by attempting to reach an average level of 10 points per week by the end of the sixth week. By the twelfth week, he should average 20 points per week, and by the eighteenth to the twenty-fourth, 30 points per week should be the goal.

Weeks	Points
1-6 weeks	10
6-12 weeks	20
12-24 weeks	30

Maintaining a 30-point-per-week average will enable most people to be classified in the good to excellent physical fitness category.

During the initial stages of training, exercise should be taken 5 to 6 times a week and be *slowly* progressive by all means. With improvement, the exercises can be made more strenuous and the frequency reduced to 3 or 4 times a week.

There are other good exercises that have not been discussed. If a person exercises regularly using a different exercise and can perform at a level compatible with the good or excellent categories mentioned previously, he should continue this practice. The level of fitness is what is needed regardless of how it is accomplished. Even with an aerobic exercise program, it is beneficial to warm up with a few flexing and extending exercises but a training program should not be planned around calisthenics alone. It is the abnormalities in the cardiovascular system that interfere so frequently with the continuation on flying status.

CONCLUSION

Currently, exercises are being used to rehabilitate people who are already suffering from heart disease, high blood pressure, and many other potentially grounding medical problems. However, once they are removed from flying status because of one of these conditions, it becomes nearly impossible to regain this status. A little preventive medicine practiced now will help to insure flying status for as long as an aviator desires to fly. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

Q. What is the difference between an *enroute penetration* and an *enroute descent*? I have been hearing both terms lately. Capt Francis E. Dunlap, 3576 Student Squadron, Vance AFB, Okla.

A. An enroute penetration is defined in FLIP II, Pilot Procedures, as "a descent from an enroute altitude to the final approach without execution of the maneuvers prescribed in FLIP Terminal High Altitude (JAL) Charts." The FAA Air Traffic Controller's Manual, AT P 7110.1B, par. 761.1, states: "When requesting an enroute penetration, the pilot will use the following phraseology: REQUEST ENROUTE PENETRATION TO (destination airport)." Turbojet enroute penetrations are based on a rate of descent of 4000 to 6000 feet per minute.

The term "ENROUTE DESCENT" can not be located in approved FAA or USAF publications. An enroute aircraft requesting a lower altitude would receive clearance by the phraseology "DESCEND AND MAINTAIN (altitude)." Upon receiving such a clearance, you should descend as rapidly as possible, consistent with safe operating procedures.

Often the pilot desires a shallow, fuel conserving descent beginning a considerable distance from the destination fix. In this situation you should state your intentions when requesting the altitude change. The controller may or may not approve such a descent.

THE USAF INSTRUMENT PILOT INSTRUCTOR SCHOOL

For those of you who may wonder just what the USAF IPIS accomplishes other than instrument flying we have prepared a brief resume of the school's activities.

The IPIS, activated in 1943, is established by AFR 53-12 and owned and operated by the Air Training Command. The school's mission stated in broad, general terms is to:

- Develop, test and standardize USAF instrument flying procedures.
- Evaluate flight instruments and flight instrument systems for the USAF.
- Train instrument instructors for the USAF and Allied Countries.

From these basic functions evolve the three major branches or sections of IPIS — Instrument Procedures Standardization Branch, Instrument Evaluation Branch, and Flight Line and Academic Training Section.

The Instrument Procedures Standardization Branch acts as the "pilot's representative" by maintaining close liaison with the FAA, ACIC and Headquarters USAF. Besides these IPIS Approach articles, their work involves FLIP, AFM 60-1, AFR 60-16 and the writing of AFM 51-37, INSTRUMENT FLYING. In addition, they participated in writing the new Terminal Instrument Procedures (TERPS). This Branch also represents USAF at all flight manual policy and command review conferences for the purpose of insuring adequate instrument flying procedures and standardizing instrument terminology.

The Instrument Evaluation Branch is the "R & D" of IPIS. They conduct operational test and evaluation of flight instruments and flight instrument systems, validate advanced control-display concepts and investigate new instrument flying techniques and procedures. To do this, the Instrument Evaluation Branch maintains close liaison with various research laboratories and engineering groups within the Research and Technology Division of Air Force Systems Command. Studies exploring the potential of (1) sharing aircraft pitch and bank control tasks between the pilot and co-pilot, (2) using command steering (flight director) information in the GCA environment, and (3) portable ILS equipment are but three of their many current projects.

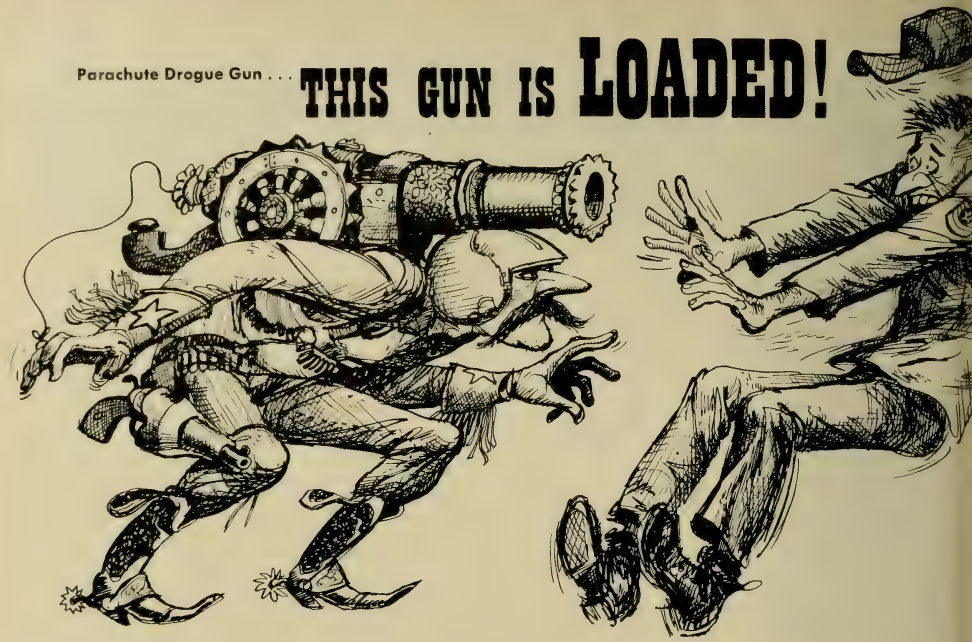
The Flight Line and Academic Section conducts the formal six-week training course here at Randolph Air Force Base. The academic instructors are responsible for teaching classes on such subjects as fundamentals of instruction, flight instruments, navigational aids, and regulations and publications. Also, these same instructors formulate and distribute the Annual Pilot's Instrument Refresher Course, with which you are all familiar.

The flight line portion is where the student puts theory into practice. The student is assigned to fly either the T-38 or T-39, whichever aircraft more closely approximates the performance of the aircraft at his home station. The course consists of 13 lessons with approximately half of the lessons devoted to instrument proficiency and observing instructing techniques used by the IPIS instructor. The student then uses these techniques and procedures, along with the knowledge gained in academics, to instruct the instructor on the remaining lessons.

Graduates will tell you, and correctly so, that another two or three hours of after duty study are required of most students if they are to gain maximum benefit from the course. Because of the short duration of the course and the large amount of material that must be covered, they will be pressed for time the entire six weeks, but after graduation the potential instrument instructor can be justifiably proud of his achievement. An Outstanding Graduate Award is given to the top two students based upon a combination of academic and flying grades. Those selected to attend IPIS should be among the unit's best pilots, both in basic instrument flying ability and in procedural knowledge. Quotas for attendance to IPIS are controlled by Headquarters, USAF. ★

Parachute Drogue Gun . . .

THIS GUN IS LOADED!



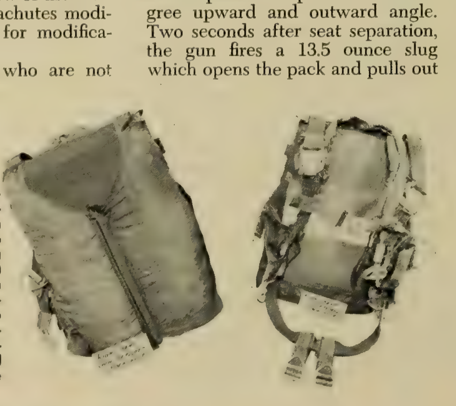
Robert H. Shannon, Safety Officer, Life Sciences Div

Installation of the Weber drogue gun in the B-18 parachute was started in late October 1965. As of this writing, there have already been four cases in which the drogue gun was inadvertently fired through carelessness. Fortunately, there were no injuries. These four occurrences in less than 60 days indicate a dangerous trend. This is particularly true in view of the relatively few BA-18 parachutes modified or programmed for modification at this time.

For those of you who are not familiar with the drogue gun, it was designed, tested and approved for the F-106 ejection seat. The gun, in conjunction with the rocket catapult, seat/man separator and other system refinements, provides for successful recovery from a static condition. Briefly, it is a ten-inch cylindrical chunk of hardware mounted in the upper right corner of the parachute pack at a 45-degree upward and outward angle. Two seconds after seat separation, the gun fires a 13.5 ounce slug which opens the pack and pulls out the pilot chute and a portion of the main chute.

Although the drogue gun concept of chute development is applicable only to the F-106 at this time, there is a great deal of support for the adoption of this system across the board for all rocket-powered ejection seats. Consequently, a great many more aircrews and maintenance personnel may be directly concerned. This *gun*, and it is a *gun*, must be treated with respect and caution. Even though it was designed to enhance the life saving capability of ejection systems, it could produce serious or lethal injury if handled carelessly.

In the four cases reported, three involved pilots and one a crew chief. In the three cases involving pilots, all occurred during attempted ground egress after normal flight. Brief summaries are presented.



Rear view of gun deployed zero-zero parachute pack is shown in photo at left. Red flap with printed warning (EXPLOSIVE DEVICE) gives instant recognition of zero-zero ejection system. Right hand photo shows parachute deployment cable that attaches to seat-mounted disconnect on left side of pack.

Case Nr 1

After completing normal cleanup of the cockpit following a flight, the pilot failed to pull the ditching handle to disconnect the arming cable of the drogue gun from the ejection seat. As he rose from the seat with the chute on, he felt a slight tug. The drogue gun had been armed, and it fired two seconds later into the canopy plexiglas. The parachute deployed behind the pilot into the cockpit. Cause; operator error — the pilot failed to disconnect the arming cable from the ejection seat before egress with the parachute.

Case Nr 2

The pilot overlooked the newly installed zero-zero parachute as he started to disembark from the aircraft. He felt a slight restraint, which immediately released. He then recalled the lanyard and sat back down in the seat. The drogue gun fired normally. The slug passed between the canopy and canopy rail and landed ten feet from the aircraft. Cause: operator error — the pilot failed to disconnect the arming cable from the ejection seat before egress with the parachute.

Case Nr 3

After engine shutdown at the completion of the flight, the pilot stood up in the seat to exit the aircraft. He did not pull the ditching lever to disconnect the cable assembly from the disconnect housing assembly. The result was as expected — the drogue gun fired and deployed the parachute. Cause: operator error—the pilot failed to disconnect the arming cable from the ejection seat before egress with the parachute.

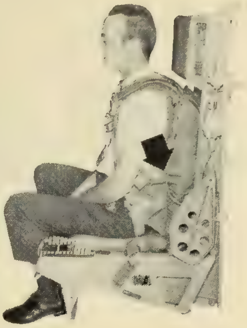
Case Nr 4

The crew chief was removing personal equipment from the aircraft cockpit in preparation for towing the aircraft back to the flightline from the alert facility. It was raining very hard and the crew chief was attempting to remove the pilot's personal equipment to prevent it from becoming wet. He was not aware that the parachute was the explosive type. In other words, "He didn't know the gun was loaded." That has a familiar ring. After releasing the survival kit snaps and the personal leads, the crew chief attempted to remove the parachute, but it seemed to be caught inside the cockpit. He replaced the parachute and examined all the leads and equipment and found nothing. He attempted to remove the parachute again and after lifting it a considerable distance, the drogue gun fired, deploying the chute. The cable assembly was still connected to the disconnect housing assembly. The primary cause of the mishap was personnel error. The crew chief failed to disconnect the cable assembly from the housing as outlined in the aircraft T.O. before attempting to remove the parachute from the aircraft.

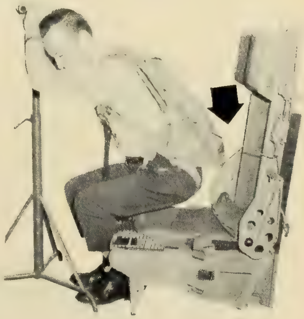
The recommendations presented in these mishaps to preclude recurrences were quite adequate and widely disseminated. They essentially involved the briefing and rebriefing of all personnel handling and maintaining the parachutes on the proper procedures and warnings as outlined in applicable technical orders. In at least one case, a possible design deficiency was indicated as a possible contributing factor. The arming cable cone should not disconnect until a 100-pound pull is exerted on the cone at a 20-degree angle. In some units subsequently checked, the arming cable cone disconnected between 20 and 47 pounds. In other words, it is probable that these inadvertent firings may have occurred with less than 100 pounds pull. This is currently being investigated by SAAMA.

It is not the intent here to belabor the personnel error aspect of these incidents. The need for complete knowledge of installed equipment, by both pilots and maintenance personnel, is very evident. This point cannot be stressed too strongly. Extreme care must be taken where explosive devices are concerned. The four cases cited here could have ended tragically. Had the crew chief been in the line of fire of the drogue slug he most certainly would have been seriously injured or killed. As for the pilots, had they been attempting to exit the aircraft after an emergency crash landing with fire present, the deployed chute could have prevented or delayed egress.

Fortunatly, no one was injured in any of these mishaps. We may not be as lucky on the next try. So, let every precaution be taken to insure there will not be another accident.



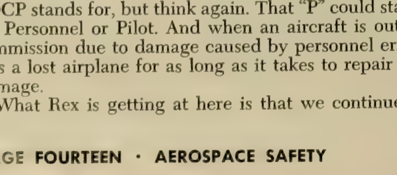
Pilot (above) in normal sitting position. Special attention must be paid to the parachute cable, as it is the triggering mechanism for the deployment gun, which is built into the chute back pack. Photo below illustrates the most common manner in which the gun deployed parachute is inadvertently fired. Pilots forget to release the deployment cable from the disconnect device, then they grab the windshield to stand up, putting pressure on the firing mechanism.



(This article was written on January 4. By press time, February 7, the number of inadvertent drogue gun firings had reached 11, indicating that the problem has reached serious proportions. — Ed.) ★

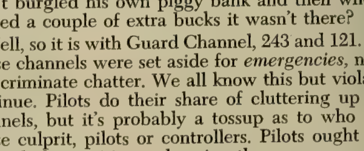
Rex Riley
CROSS COUNTRY NOTE

FLAMMABLE CUPS. It was recently brought to Rex's attention that those white styrofoam cups that some of us use for coffee and also as ash trays in an emergency are flammable. So Rex did a little research (he set one of these cups on fire) and found that they do burn right smartly. And in the process a great deal of black, sticky soot is given off. It is recommended that anyone curious enough to try this for himself take it outside before lighting. We're still cleaning up the office and the girls have been giving Rex dirty looks for days. A recommendation has been made to proper authorities that the use of these cups aboard aircraft be discontinued.



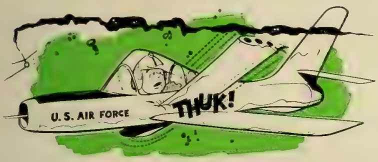
PROBABLY EVERY Air Force pilot knows what AOCP stands for, but think again. That "P" could stand for Personnel or Pilot. And when an aircraft is out of commission due to damage caused by personnel error, it is a lost airplane for as long as it takes to repair the damage.

What Rex is getting at here is that we continue to have those nasty little accidents that put our birds in the shop when they ought to be flying missions. Here's an example: As the aircraft attempted to turn 180 degrees on a congested ramp, the right wing heater pod struck a concrete column. The weather was good and it was broad daylight. Problem: No wing walkers!



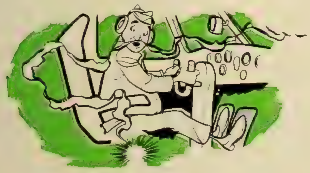
LIVES THERE a soul who at some time or other hasn't burgled his own piggy bank and then when he needed a couple of extra bucks it wasn't there?

Well, so it is with Guard Channel, 243 and 121. 5 mc. These channels were set aside for *emergencies*, not for indiscriminate chatter. We all know this but violations continue. Pilots do their share of cluttering up these channels, but it's probably a tossup as to who is the worse culprit, pilots or controllers. Pilots ought to be particularly sensitive to keeping the emergency channels clear, after all they might be in need some time. And while controllers don't face the threat of a sudden emergency that could find them bailing out or needing immediate assistance for a safe recovery, they do have the responsibility of assisting the man in the air. In fact, that is their primary responsibility. Chattering on Guard Channel is not compatible with that responsibility.



FORMATION FLYING is exacting and requires constant attention to the task. As pointed out in an article in the September, 1965 issue of AEROSPACE SAFETY, most mishaps that occur during formation flight result from pilot inattention and sometimes the result is disastrous. Recently a pair of F-84's were tooling along and Lead called for his wingman to join up. While closing on Lead the wingman was momentarily distracted by another aircraft, and as he glanced at it, the left wingtip of his aircraft struck the right wing of Lead.

After checking each other and making a flyby past mobile, the two pilots determined that the aircraft were controllable and landed safely. Both wingtips were damaged and an aileron of one was bent. Time to repair was estimated at 80 hours, a costly moment of distraction that could have been much more costly.



EFFICIENT HEATER. Here's an item that should be read by all T-39 drivers, so pass it along to your friends who fly the bird.

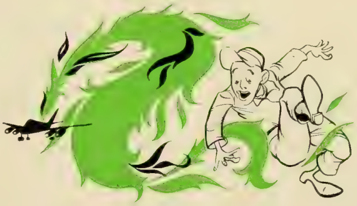
After about one and one-half hours of flight the pilots of a T-39A began to smell an odor indicating an electrical fire. This was followed by light smoke. After checking all instruments and circuit breakers and finding nothing amiss, the pilot switched off the footwarmer, which was installed IAW T.O. 1T-39-758. With the footwarmer off, the smoke and fumes dissipated.

Source of these irritants was the pilot's helmet and helmet bag that he had stowed under his seat in front of the footwarmer. The heater produced enough heat to scorch the bag, deform the helmet and melt the styrofoam pad inside.

This aircraft was the only one equipped with this heater, but you should have this equipment on your bird soon. Remember, don't place anything under the seat near the heater-blower duct. And if you smell fumes you might check there first.

BAD BULB — An unsafe gear indication will always make a pilot nervous, but thorough knowledge of the aircraft systems should keep the adrenalin at low pressure. When the pilot of an F-102 didn't get a light in the right main gear, apparently his only thought was that the gear was unsafe. So he used the emergency system and got a safe indication. Then secondary hydraulic pressure failed. An emergency was declared and a safe landing was made.

The report indicates the only real problem was that the pilot did not try the press-to-test feature to detect a defective bulb. Apparently the secondary hydraulic system failure resulted from a shuttle valve failing to seat, although it later checked out okay.

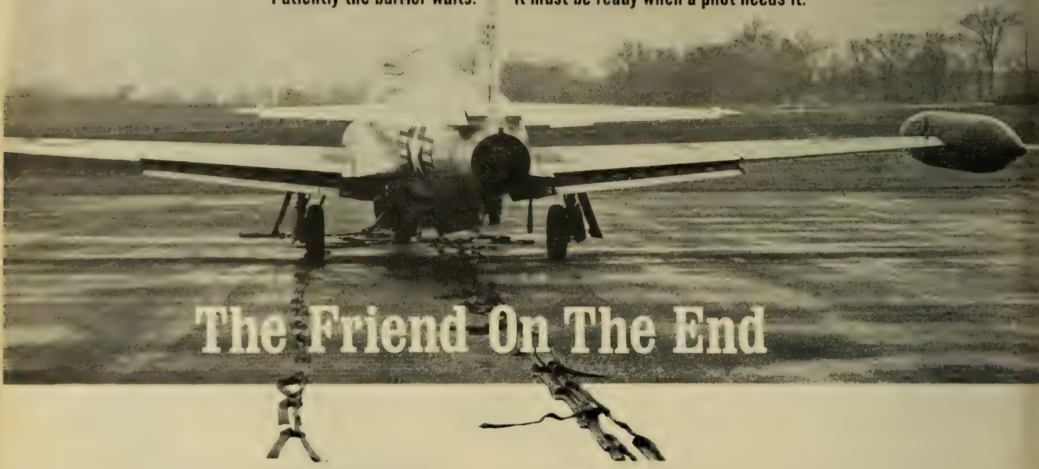


FIRE IS probably the most feared hazard around aircraft, yet we continue to have fires resulting from carelessness and lack of suitable precaution. Rex is passing on the following in hopes that a similar mishap might be prevented from happening elsewhere. A trash can was used for draining fuel and the can was left where it could be reached by the aircraft starter exhaust. The result, of course, was a fire. During the investigation this was determined to be the immediate cause, but there were, as usual, several contributing factors:

- The engine run-up supervisor permitted an unsuitable receptacle to be used as a fuel drain can.
- There was inadequate lighting.
- The run-up supervisor had no positive means of communication with the forward fire observer.
- There was no directive prescribing the use and positioning of drain cans during engine starts.
- An airman who was not highly qualified was permitted to perform engine run-ups.
- Supervisory personnel had not established a standardized procedure to inform the engine operator of a fire.

Needless to say, action was taken by the unit to correct each of the deficiencies cited above. How about your procedures? If you aren't sure, better take a look. ★

Patiently the barrier waits. It must be ready when a pilot needs it.



The Friend On The End

William M. Purcell, Barrier Project Officer, AFFTC, Edwards AFB, Calif.

Picture, if you will, a pilot who has aborted his takeoff at rotation speed. Here is a man guiding his multi-million dollar weapon system toward the end of the runway at 180 knots calling, "Barrier! Barrier!" Now the moment of truth has arrived. It's too late to ponder the problems of barrier maintenance. A 25-ton aircraft is using up the runway at the rate of a football field a second, with only the barrier standing in the path of disaster. Now everything has to be right. The maintenance that the barrier has been receiving is about to be put to the test.

This picture that I have painted is not hypothetical. It can and does occur on a daily basis. No runway is immune. Aircraft overrun 12,000-foot runways the same as they do 7000-foot runways. The best weather coupled with a long runway will not prevent an aircraft overrun. They run off the runway end without warning or regard to time of day or season of the year. There is no pattern or trend in aircraft overruns; they are random emergencies. The arresting equipment is placed at the runway end to keep these random emergencies from becoming random catastrophies.

The responsibility for seeing that the barrier is ready when a potential catastrophe presents itself falls squarely upon the shoulders of the maintenance personnel. So let's consider some generalities of maintenance, especially barrier maintenance.

Even though the pilots' need for the barrier is not predictable, the barrier's need for maintenance is quite predictable, and experience tells us that the barrier needs more maintenance attention during the winter months. The nature of the barrier's use places a certain amount of strain on the maintenance operation. The barrier stands patiently at the runway end for indefinite time periods. One Air Force base had six barrier penetrations in five days; others have never had a barrier contact. In any case, the barrier must be kept in a state of constant readiness.

The first and foremost aspect of barrier maintenance rests with the technical orders. The T.O.'s must be kept current and available to the mechanics. The best T.O.'s in the Air Force are of very little help if they are out-dated or hidden in a desk drawer. But even if the T.O.'s are available and completely current, the barrier mechanic has to read them. He has to go through them carefully and critically until he understands what is expected of him. Information is available on any aspect of the barrier operation but only if the people with the answers are aware of the questions. Another important thing to consider is that no T.O. can be improved until the engineers who wrote it are aware of its deficiencies. It is better to correct the T.O. before an accident than to try to explain what happened to an accident board.

Another very important aspect of barrier maintenance is for the people charged with the maintenance of the barrier to be familiar with the systems, and this can be accomplished only by spending some time with the system. A maintenance mechanic, in this respect, is very much like a theatrical performer. He must rehearse so that when the time comes, he can perform.

Now for some particulars of barrier maintenance. Here is a list of things to keep your eye on, especially during the winter months:

Arresting Cables or Runway Pendants

The arresting cable must be carefully checked on a regular basis. Broken or flattened strands and corrosions should be noted. The replacement criteria in the T.O.'s should be followed to the letter. Regardless of what the cable may look like, or the seeming waste involved in replacing it, do what the T.O. says. Remember: it is far better to discard a seemingly useful cable than to have that same cable fail during an arrestment. The proper cable tension must be maintained to assure reliable hook engagements. Repeated taxing over the arresting cable will cause the pretension to decrease. The pretension must be right or the chances of a successful hook engagement are reduced and the possibility of aircraft damage during taxing over the cable are increased.

Cable Supports

The cable supports are the heart of the arresting hook engagement concept and therefore must be in good condition to allow reliable engagements. The condition of the cable supports is particularly critical when the engaging speeds increase above 120 knots. Poor cable supports reduce the chances of successfull engagements and the results of an unsuccessful high speed engagement are disastrous. So when a cable support starts to look the least bit "dogeared" or cracked around the center or just does not stand upright while supporting the cable, replace it.

MA-1A Nylon Net Engaging Device

The MA-1A nylon net engaging device is a simple appearing device, but don't let it fool you. The MA-1A net is unforgiving; it has to be right or it won't work. The heart of the net is the slack in the arresting cable. If the cable is too tight or too loose, somebody is going to be disappointed when he drives his aircraft into it. There must be four feet of slack in the arresting cable. The procedures for providing the proper slack and for checking the slack are clearly stated in the T.O. So get it right. In addition, the nylon is seriously weakened by sunlight. So again, follow the nylon net replacement criteria in the T.O. to the letter.

Another important thing to keep an eye on is the shear pins used on the MA-1A. I have found all sorts of wires, nails, pegs and pins and even bolts used instead of shear pins. The condition of the shear pins is important, too. Here again, use the T.O. to get it and keep it right.

BAK-6 Water Squeezer

The BAK-6 water squeezer is a simple, reliable barrier, but it, too, requires conscientious maintenance. The tubes must be checked for proper water level, and anti-freeze mixtures. The mixing procedures are of utmost importance especially during cold weather. If the water level is too high or if the anti-freeze is not in the proper proportion or not regularly mixed, the system may freeze solid. If the water level is too low, the BAK-6 may not stop the aircraft. The entire system must be constantly checked to be sure that everything is free to move.

A case in point comes to mind. At a northern base one February an F-106 engaged the BAK-6 at the end of a 12,700-foot runway at about 80 knots. One tube of the BAK-6 was frozen solid. The 106 came to rest sticking out of a snow bank. The investigation disclosed that a regrading project diverted surface water into the BAK-6 tube where it froze solid.

BAK-9 and BAK-12 Barrier Systems

Because of the similarity of the two systems, we'll consider them together. The BAK-9 and BAK-12 systems are very reliable systems; however, they are not maintenance-free. The hydraulic levels and pressures must be checked regularly. If the hydraulic level is too low, the barrier will not stop the aircraft. For example, an F-105 at a European base engaged the BAK-9 at about 130 knots. The BAK-9 was low on hydraulic fluid so the proper brake pressures could not build up and the bird did not stop in the overrun. The aircraft ended up minus some very important landing gear.

If the systems will not maintain the pretension pressures, the arresting cable will not be held under the proper tension and the chances of a successful hook engagement are greatly reduced, especially at high speed. The tape connectors must be carefully checked for proper installation and for cracks after every engagement. The use of the automobile tire casing around the tape connectors as shown in the T.O. will significantly reduce tape connector problems. The nylon purchase tape must also be carefully checked for small cuts and excessive wear. In the early days of the BAK-9 it was discovered that European field mice found the nylon BAK-9 tapes make excellent nesting material. A rodent repellant treatment on the tapes will solve this little problem but keep your eyes open. The replacement criteria in the T.O. must be followed to the letter. The subsurface tubes and pulleys must also be checked for foreign objects and freedom of operation, especially during the winter months.

And speaking of the winter months, here are a few things to keep in mind. Water that enters small areas and then freezes is a source of constant trouble. The presence of ice and snow in the barrier area will change the drainage patterns so that what was adequate drainage during the fair weather months may no longer be adequate in winter. It is far easier to keep water out of the equipment than it is to get the ice out after it forms. Another thing to watch: if the equipment is installed in subsurface pits, the sump pump must be kept in commission and the pump outlet must not freeze closed or the pit will fill up with water. This situation has occurred, much to the surprise and disappointment of the people involved. Situations where cyclic freeze-thaw conditions occur for a period of time are also pure trouble for barrier maintenance personnel.

In addition to the specifics, there are countless little things to check and double check. Things like proper shear pins, proper lubricants, fluid levels, preservatives must be watched closely.

Barriers are not maintenance free, but with the proper tools and techniques, the maintenance of the barriers can be accomplished quickly and efficiently. As a general rule, barrier maintenance is no different from any other maintenance; simply do what it says in the T.O. and when there is a doubt, find out. In this manner, the barrier will be ready when a pilot needs it. When a pilot needs the barrier, nothing else will satisfy him. ★

Insurance Anyone?

Maj George H. Tully, Chief, Flight Safety, AFSC, Scott AFB, Ill

For readers of AEROSPACE SAFETY, this article should probe the storage portion of your brain and perhaps recall the similar write-ups entitled, "Look for the Lightning Bolt" or "Who Checks the Controller." These were published to familiarize you with the Air Force Communications Service Air Traffic Control Service Evaluation Program. To insure that we're all on the right track, here's a little review on the subject.

AFCS is responsible for providing air traffic control on all USAF bases world-wide. To do this job, we stack up manpower and equipment-wise as follows:

Controllers	5542
NAVAIDS	578
GCA's	125
RAPCON's	70

Impressive figures, aren't they? In addition to the large numbers involved, world-wide locations of the command facilities and people are also quite impressive. Crank in airspace problems of the various overseas areas, inter-facility (USAF to Foreign National) coordination, training time to facility-rate newly arrived controllers, etc. and you'll soon realize that the USAF Air Traffic Control business is big business — and — extremely important business.

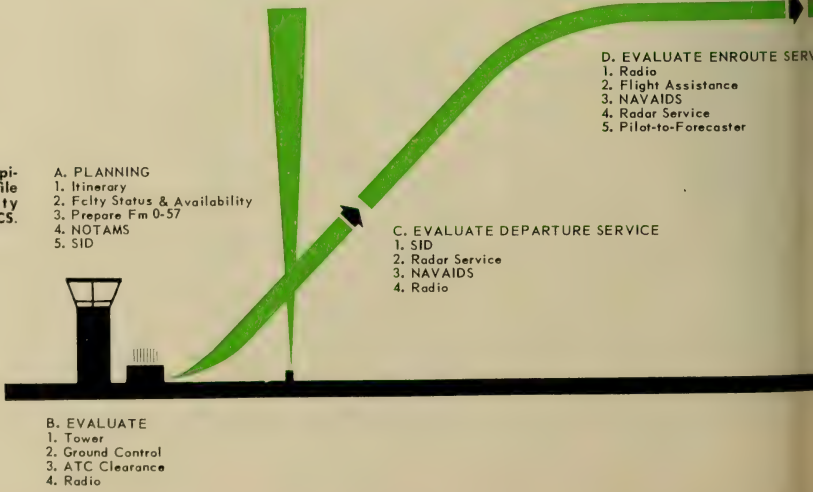
Factors have appeared over the past few years that have affected our operation. Long term NCO's who had spent 20 years in the ATC business began to retire. Many of these were our primary supervisors. Long-term flight facilities officers began to be released from duty via the 20-year program. Overseas commitments fluctuated, making planned moves of proper skill level airmen and NCO's a problem. These and other factors combined to create a probable decrease in the quality and effectiveness of the service we, in AFCS, are obligated to provide.

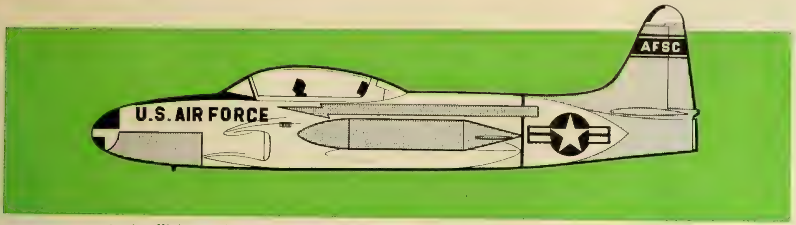
The preceding background produces a big question! "What did AFCS do in the management area to insure strong professional continuance of the vital air traffic services required?"

Several methods of operation were considered. To make the tale short and to the point, we activated a "service evaluation" program. We manned the pilot spaces involved with jet-qualified air traffic control officers. We acquired nine T-33 aircraft with which to do the job world-wide. Special equipment? — Not much! A distinctive anti-collision type paint job on the bird and a small portable tape recorder in the rear cockpit. That's the size of it. With these nine aircraft (five in the ZI; the other four in overseas areas), each USAF terminal facility has been evaluated at least once each 45 to 60 days for the past three and one-half years. It's a

Fig 2

Drawing depicts typical mission profile flown by facility check pilots of AFCS.





Anti-collision paint causes T-33 facility check aircraft to stand out in a crowd.

big job, done with a minimum of people and equipment, but a proven tool in checking our air traffic control quality and professionalism. Needless to say, safety of flight is the paramount consideration on all evaluations.

To describe the mission, we'll use an example. Let's take a look at our 1866th Facility Checking Squadron based at Scott AFB, Ill., and responsible for 128 ZI locations. Since unit activation, they have accumulated over 4000 service evaluation sorties with over 8000 flying hours. Three aircraft leave Scott every Tuesday morning. A typical mission profile might be: Scott to Clinton Sherman, evaluate and debrief; Clinton Sherman to Walker, evaluate and debrief; RON. Second day, same procedure—Walker to Laughlin; Laughlin to Carswell; RON. Third day, Carswell to Barksdale; Barksdale to Perrin; Perrin, return to Scott. The other two mission aircraft dispatched have headed NW, NE, or SE and accomplished a similar circuit. A three-day mission – six base evaluations, two RON's, and about 12 to 14 hours flying time is accompished. Add on six arrival debriefings (one to two hours each), and you can see it's quite a chore.

Each evaluation is debriefed on arrival. Minimum personnel debriefed are the AFCS Flight Facilites Officer and the base FAA representative. Additional attendees range from base flying safety and operations officers to wing operation officers. Upon crew return to home station, each evaluation sortie is put into written form and forwarded to the unit for corrective action as necessary. You might compare this overall effort to an ORI. Although of only 30 – 45 minutes duration (on the facility, excluding enroute time), the evaluation is actually a no-notice ORI of the particular terminal air traffic control complex.

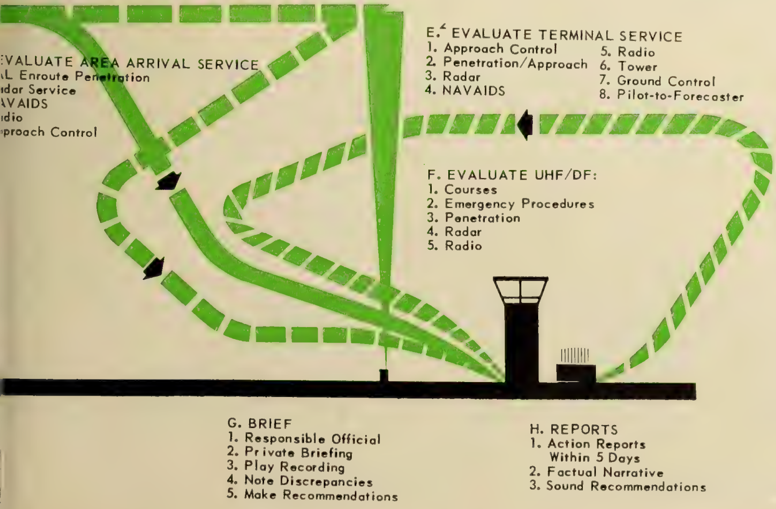
For a picture portrayal of the mission, see the diagram below.

So, without running this tale into the ground, that's a brief description of our program, why we have it, and the accomplishments to date. What have we learned? Have improvements resulted? To cite a few:

1. Better coordination between facilities; i.e., GCA, tower, RAP – CON, etc.
2. Improved supervision of trainees.
3. Better communications quality.
4. Better emergency procedure response.
5. Standardization of air traffic control procedures.

Incidentally, don't let this article lead you to believe that the AFCS Air Traffic Services normally provided are sub-standard or inadequate. We're proud of our air traffic controllers and the service they deliver. They're a dedicated and hard-working group who realize the responsibilities of their duties.

"Insurance Anyone" may seem like a strange title for an article of this type. A little thought may prove otherwise. AFCS is providing you with insurance — free insurance. No premiums to pay, no due dates, or any other requirements. Through our command service evaluations and professionalism in our air traffic service, you, the USAF Aircrewman, are being assured of safe, efficient handling on each and every flight. ★



FAA ADVISORIES

Walter J. Wrentmore
FAA Liaison Officer
Directorate of Aerospace Safety

LOOK, ACT AND LIVE. To military pilots it must seem that air traffic appears to be approaching a density comparable to that of some of our highways.

This should not come as a surprise, for the General Aviation aircraft fleet is growing like the proverbial weed, a growth which is expected to continue. The definition of General Aviation aircraft encompasses all civil aircraft except for the air carriers. This growth has resulted in an increase from 53,890 active aircraft in 1954 to 95,372 as of September 30, 1965. Total aircraft operations at FAA facilities during calendar year 1965 were a record 37,370,000, an increase of nine per cent over calendar year 1964. Of this total 26,209,000, or 70 per cent comprised activity by General Aviation aircraft, an increase in this category of 14 per cent. By comparison General Aviation aircraft accounted for only 11 per cent of the 12,860,000 aircraft handled by FAA facilities on IFR clearances during the year. Statistical figures shown are projections for the fourth quarter based upon data compiled for the first three quarters ending September 30, 1965.

Obviously, statistics such as these can only indicate that the majority of General Aviation pilots conduct their flying activity in VFR conditions. Some file VFR flight plans; many do not, despite the fact they are encouraged to do so. The only requirement, insofar as VFR flying is concerned, is compliance with basic VFR weather minima and cruising altitudes as outlined in Federal Aviation Regulation, Part 91. In complying with the aforementioned regulation the VFR pilot is as justly entitled to the use of airspace from the surface to 23,000 feet as is the pilot operating at an assigned altitude on an IFR clearance.

Thus, a pilot flying at an assigned altitude of 9000 feet, operating under an IFR clearance, is subject to encountering VFR traffic at either 8500 or 9500 feet, depending upon direction of flight and providing basic VFR weather conditions exist. VFR traffic may likewise be encountered at all altitudes, under the same conditions, while they are climbing to or descending from cruising altitudes. Add such factors as altimeter error and variations in pilot techniques and the potential for a collision, or near midair collision, can be substantially increased unless pilots are alertly scanning the skies and immediately take avoidance actions as outlined under right-of-way rules.

Bear in mind this is not a one way street, for the military services in recent years have invaded the bug smasher domain with high speed jet aircraft conducting much of their training activity along low level VFR routes, operating under essentially the same basic visual flight rule criteria. This poses a considerable traffic hazard to the small plane pilot, for not only is he faced with the possibility of collision, but he must also face the realization that severe damage can result from an encounter with wake turbulence from a high speed jet aircraft.

Ground radar is not the cure-all to the collision avoidance problem, and research efforts over the years have so far failed to produce a satisfactory collision avoidance system. The Positive Control environment, Flight Levels 240-600, has benefited users of this airspace tremendously, has resulted in more efficient control of traffic and a continual decrease in incidents. Remember, however, even the aircraft using this airspace have to ascend and descend, as do General Aviation and military aircraft operating in low altitude airspace, thereby creating an environment of heaviest congestion in and around terminal areas.

The only tried and proven method of collision avoidance is constant vigilance and use of good common sense by every pilot and crewmember. Constant surveillance, vigilance and alertness can lead down the road to successful accomplishment and happy retirement, rather than to the Bureau of Vital Statistics. ★

Missilanea

LOOSE SCREEN – An AGM-28 was placed in Combined Systems for a calendar inspection checkout. The engine screen was installed by a fully qualified combined systems crew. Walk-around inspection of the missile had been completed and no discrepancies noted. After completion of combined systems checkout, the screen was found to be loose in the engine-inlet. When the screen was removed, damage to the engine-inlet diffuser was discovered.

Obviously a case of personnel and supervisory error: improper installation of the engine-inlet screen and an inadequate inspection by supervisory personnel. Since the engine diffuser is very fragile, it is necessary to exercise extreme care in the installation of engine screens and engine-inlet protective covers.

WATCH THAT TUG – Preparations were being made to remove from a hangar an AGM-28 which was mounted on an H2-33 trailer. The MB-4 tug was parked about four feet from the missile. When the tug operator started the motor, the tug immediately moved in reverse towards the AGM-28 and two airmen who were at the tongue of the trailer waiting to hook it to the MB-4. The tug operator attempted to apply brakes, but his foot struck the accelerator as the brake pedal was depressed. The moving vehicle knocked one of the airmen into the AGM-28 missile exhaust cover which caused minor damage to the missile exhaust cone cowling. The airman was admitted to the hospital for observation and later returned to duty.

Personnel error by the tug operator was chalked up as the primary cause of the mishap because he had released the brake, failed to disengage the electric clutch, and failed to move the gear selector level from reverse to neutral before starting the engine. A contributing cause was an incorrectly wired breaker safety switch which prevents engine start with the transmission engaged.

It is recommended that operator checklists be installed in towing vehicles and all MB-4 tugs be checked to insure that the breaker safety switch is wired correctly.

Maj Edward D. Jenkins
Directorate of Aerospace Safety

WING WALKERS WANTED – An AGM 28 "Hound Dog" was being towed into a maintenance facility. The tug driver was carefully judging his clearance to the door casing and his *one* wing walker was doing all he could to assist. Nevertheless, the right wing tip contacted the casing. Why? Primarily due to an insufficient number of wing walkers. AFM 127-201, Figure 11-6, paragraphs 18 & 19, state that at least three guides will be used. In addition, AFM 127-101 (formerly AFM 32-3) Chapter 8, Par 0804. 2(4) (c) and (d), states that when towing near obstructions, a wing walker will be used for each wing and a supervisor will be located in the front where he can see *both* wing walkers and the tug driver.

It would be in the interest of all AGM 28 units and depots to apply the same criteria to the "Hound Dog." Then we stand a better chance of defeating the old, well-known towing law: "If the wing can physically contact an obstruction, it eventually will."

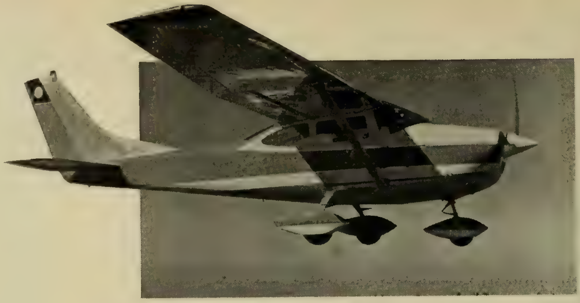
Capt Robert A. Boese
Directorate of Aerospace Safety

BARGAIN DAY – OR, $5000 FOR A .25c FUSE. Dump one more Bullpup! It has been said that every time "history repeats itself," it does so at a higher price. The aircraft missile launch and control system checked okay, the missile loading was good, and the inflight command link check was made.

When the missile was launched, it would not respond to the pilot's control actions. Although the aircraft and missile crystals were correctly mated, the range monitor showed that no command signals were being transmitted from the launch aircraft.

After the aircraft landed, the sharp investigation team had the malfunction isolated, and the cause determined in a matter of seconds. The malfunction was a blown RF amplifier fuse. The cause – personnel and supervisor error. TCTO 12R3-2ARW73-501, dated 13 Mar 1963, was not complied with. This TO required the fuse to be changed to one of a higher amperage rating. An expensive missile was wasted, valuable pilot training lost, and history has repeated itself. "For want of a nail, the shoe, the horse, the rider, the battle, the kingdom was lost." For want of the correct .25c RF amplifier fuse, the $5000 missile was lost. ★

Maj H. M. Butler
Directorate of Aerospace Safety



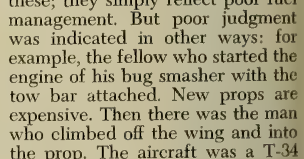
How are the little guys doing?

This article started out to be a quick look at Air Force aero club performance during 1965, a sort of how are they doing? Do they need to improve? And how best to realize needed improvements. Then when we began looking at the figures, the task appeared to become more complicated.

First, we discovered that about half of the clubs qualified for a no-accident award. This was happy news until we found that the total number of accidents and incidents exceeded that of the previous year. Fortunately, the increase was in the incident category; we had fewer mishaps classified as accidents. (Any mishap resulting in more than $300 damage, a fatality or serious injury or fire in flight is reportable as an accident.) Accidents were down about 25 per cent but the number of incidents more than doubled. Most alarming was that the number of fatal accidents increased and the number of fatalities almost doubled. As for the primary cause, pilot factor increased for total accidents and incidents but decreased when only accidents are considered. Maintenance factor remained very low (two) while materiel failure increased considerably. (For purpose of analysis, accidents and incidents will not be differentiated unless so stated, and numbers given will include both of these categories.)

Perhaps it is not surprising, in view of the number of students in the aero club program, that nearly half of the mishaps occurred on the ground or in the air in the vicinity of the runway. This includes all kinds of things such as taxiing into a ditch, a pile of dirt or a soft spot; gear-up landings and gear retraction on the ground; running into other aircraft or obstructions; ground loops and similar occurrences. These mishaps indicate that instruction in some clubs may not be all it should be since a number of these involved student pilots. Reinforcing this conclusion is the fact that three accidents occurred during simulated forced landings.

Poor judgment was indicated by several accidents, four of which resulted from fuel starvation. There wasn't much excuse for three of these; they simply reflect poor fuel management. But poor judgment was indicated in other ways: for example, the fellow who started the engine of his bug smasher with the tow bar attached. New props are expensive. Then there was the man who climbed off the wing and into the prop. The aircraft was a T-34 and the pilot assumed that his passenger, another aero club pilot, would deplane in the normal manner, that is, off the rear of the wing.



Sad aftermath of an aero club accident. T-34, right, is main offender in gear up landings.

To his surprise, the man decided for some reason to go off toward the front and he was struck by the propeller.

The fatal accidents are, of course, the most distressing. There were six accidents in this category, with 14 deaths. (One pilot had been missing for two months, as of this writing, and was presumed dead.) The cause factors add up as follows: maintenance — one, undetermined — one, pilot — four.

One of the most difficult problems of a voluntary organization is maintaining discipline among its members. Ninety-nine out of 100 may be responsible individuals who obey the rules and work for the betterment of the organization. Then that other one per cent can ruin the whole show. This is particularly unfortunate for an aero club because of the cost of aircraft and the hazards that accompany flagrant breaking of the rules.

Unfortunately, some of our fatal accidents occurred when the pilot deliberately violated an aero club regulation: the rule concerning night cross-country flying. Weather was also a factor.

By regulation, aero club pilots not possessing an instrument rating are forbidden to fly outside the local area at night. While some of the rules seem over-restrictive, this is one with which we can find no fault.

In an effort to prevent violation of this and other rules, rather elaborate precautions have been prescribed: pilots must file a cross-country itinerary with club officials well in advance of the intended flight. Then, prior to departure, they must file a DD 175 and produce a completed Form 21a in order to receive clearance for the flight. A briefing by the clearing officer is also required.

Once the pilot has left his home field, there's not much anyone can do to insure that the rules will be obeyed. (Several means of accomplishing this are currently being considered.) Two who broke the rules after leaving home found out the hard way that there is a reason for rules:

- The pilot possessed a private license and had approximately 450 hours of flying time. He had filed an itinerary and apparently followed it until about half way home on the return trip. After refueling at a civilian airport, he filed a VFR flight plan that would take him over some of the most hazardous terrain in the country. Takeoff was shortly after dark for this 3 plus 50 leg of his trip. The last communication with this man was about five minutes after takeoff. He has not been heard from since and no wreckage has been found. It is thought that the aircraft crashed in a mountainous area and that the wreckage is probably covered with snow.

This pilot had limited night experience, was not instrument rated and attempted to fly over a mountainous area that is sparsely populated and where there are very few lights. We can only speculate as to what happened, but it is reasonable to assume that he may have become disoriented or that, in the event of an engine malfunction, he had practically no chance to accomplish a safe landing.

- One month later to the day, a young officer and his wife were killed when their light aircraft crashed into the side of a mountain at night. Departure from their home station was during the day with a refueling stop a few hundred miles down the road. Somewhere there was a delay and takeoff from the refueling point was at 1910. This pilot was in radio contact with an FSS only a few minutes before the crash. Apparently the aircraft was flown into the mountainside with the occupants being unaware of the hazard ahead. Weather probably was a factor also. The pilot had only 250 hours and no instrument qualifications.

These two examples illustrate the seriousness of the hazards existing at night in remote areas — something experienced Air Force pilots appreciate but which inexperienced pilots may not recognize. This, of course, is one reason for the ban on night flying for pilots who do not have an instrument rating. Another reason is that with a single engine aircraft, when the engine quits, there is no reserve and at night this is essential.

We all know that breaking a rule does not in itself cause an accident. But for some strange reason, some of us fail to realize that many rules are made for the purpose of erecting a barrier against a hazard. Most of us are gamblers, but when you bet your life, you've also got to realize that there are bound to be some losers.

We wish we had a sure-fire way of preventing these disasters, but we haven't. Obviously piling on more rules that say "thou shalt not" won't solve the problem. And threats don't seem to be effective against the man who is willing to bet his life. If he wins, who will know he broke a rule? If he loses, he has already paid the ultimate price.

As for the type of accidents and incidents that predominate in aero club flying, we think something can be done. Instructors can prevent many of these with closer supervision of students and by imposing higher standards. We simply can't afford the marginal student who very possibly will become the marginal pilot. ★

Poor fuel management caused this accident. Pilot and passenger were lucky to escape without critical injuries.

Veteran accident investigators express . . .

Some thoughts on accident investigations

It is fortunate that only a relatively small number of Air Force personnel become involved in the investigation of aircraft, missile, nuclear, ground, explosive or other type of accident. Even fewer are the crew members, operators, or users who become the unwilling subjects of these investigations. What of the investigator? The investigated? The investigation? Do they always measure up to the high ethical standards expected in the United States of America?

No man, machine, condition or environment should be presumed to have been the cause factor at the time an accident investigation effort begins; these varied entities are merely the bits and pieces and clues to an intricate and puzzling detection problem. How many times have you heard the expression, "Bring in the guilty party and well give him a fair trial"? This is the last thought which should be in your mind if you are an investigator. It is a challenge to you personally to seek, sort out, and analyze every facet that seems to have some bearing on the mishap. After each possible avenue has been explored and categorized as to its effect on the accident, then, and only then, are you ready to make an intelligent assessment of the cause. It is your moral and ethical responsibility to do this job right, regardless of the consequences. Your duty is that of both judge and jury and there is little right of appeal by a "guilty" human when one is charged with responsibility for causing an accident.

Now take stock of yourself, Mr. Investigator, USAF! During that last accident you worked on, did you dig into all aspects of the mishap and examine every piece of evidence until it was possible to honestly separate the pertinent from the extraneous? Or did you chase down the big and apparent clues and come to an easy and quick conclusion because the cause appeared to be obvious, or you were in a hurry to get home?

What about the witness statements? In almost every instance it is possible to get far more "expert" witnesses than can possibly be used. So how do you get rid of the extra statements they make? Some repetitious ones can go. Some which have no bearing as the investigation develops can go. Those that don't agree with your thoughts *do not go*, at least not for that reason. A word about statements: they should be the private thoughts of the witness, expressed in his own words in narrative form. (They may be in poor grammar but for Pete's sake don't edit!) Questions and answers are not normally considered part of a witness statement!

How about TDRs, URs, laboratory analyses, stress data reports, photographs, wreckage diagrams, local directives and SOPs and many other bits and pieces of information? Gather and evaluate them carefully, then include or exclude them to show what happened to support the decisions of the investigating board.

Formal board proceedings and witness group activities should be recorded as they occur, with minutes taken of what transpires during each meeting. When did the sessions begin and end? Who attended? Who were the witnesses? Was the purpose of the investigation explained to each witness? What questions were asked and by whom? What were the answers? These are a few of the areas in which the board really does not have any choice about what it reports — it should be a verbatim transcript. If there are industry representatives assisting the board, the record must show when they were in attendance, their status there, and the extent of their participation.

Finally, the analysis of all evidence should lead to one of ten possible cause factors with a proper and definitive statement to get the details across: "The primary cause of this accident was . . . factor in that. . . ."

Take the time to document information properly. Allow the witnesses to read and sign their statements after the typists have made them ready for reproduction. Have the group reports signed and validated by the people who are supposed to do this, not just someone who is handy. A word of caution: only USAF personnel are authorized to sign any portion of an accident report. Industry personnel are authorized only as advisors or consultants and are not allowed in any board meeting where deliberations leading to findings, recommendations or other final actions are being considered. (It goes without saying that personnel involved as witnesses and operators have no business in these meetings, either.)

A final thought: When you are conducting an investigation by yourself or as a member of a large board, keep in mind that you are dabbling with the career and the hopes of a fellow member of the Air Force. Treat him at least the way you would want to be treated if the situation were reversed. There is no firm time limit on the investigation of accidents — there are no bonus points for speed. If it takes 10 hours, 10 days or 10 weeks to get the job done, take the time. Extensions of suspense dates are granted when needed, provided you are not dawdling. The total and final objective of investigation of USAF accidents is to learn what went wrong so that proper and timely action can be taken to prevent recurrence. *We want to prevent accidents from happening. We don't like to investigate and explain them!* ★

FLIGHT TESTING — 1966

Maj. Milton J. Uzelac, Chief, Flight Test Group, AFLC

There are many very competent crewmembers performing flight tests, but, due to the lack of established procedures, each troop develops his own way of getting the job done.

Recognizing that the quality of the flight test relates directly to the knowledge and experience of the individual conducting the test, Air Force Logistics Command is attempting to resolve the problem of standardized inflight system analysis by developing a Functional Check Flight Procedures Manual (FCFP). The objective is to marry engineering and flight test experience in order to determine the best way of insuring that each system is capable of fulfilling its design function. Once implemented, the combat effectiveness of USAF weapons systems can only go one way — up.

The initial step was to call upon experienced test pilots from all major commands. Opinions were voiced. Ideas were thrown on the table. The result was a set of procedures for thoroughly checking out each system of each aircraft. These procedures were then published in a new tech order known as the -6CF-1 or the FCFP.

It works like this. If you are a quality control test pilot flying F-105's, you will find your guidance in T.O. 1F-105D-6CF-1. When AFLC completes the project, one of these publications will exist for each type, model, and series aircraft in the inventory.

You might want to call the Dash Six the flight test Pilot Handbook but that's really not right. The Dash One tells us how the aircraft is to be flown. Coupled with it, the FCFP tells us how to check each system. If you think you have a better procedure for analyzing a system, we would like to hear about it. Submit an AFTO Form 22 and let AFLC have a look at your idea.

The new -6CF-1 publications will also provide an excellent training manual for the young buck who has just been selected as a squadron FCF pilot. Whether an old hand or a new troop, all test pilots and crewmembers should find the new approach a valuable aid in providing quality maintenance and a safer flying machine for the pilots who perform the operational missions. ★

Aerobits

VOODOO WATUSI. Not to be outdone by her female compatriots in the "human" race, the Voodoo has come out with a dance of her own. For those of you who haven't been aboard when she has gone into her shimmy, you can take it from those who have—it is wild!! It's a real go-goer and sure shakes loose the radar system or ballast in the front end. Normally she also gets hard to manage because she gets so worked up she shears her scissors and loses all front end control.

Many of the Voodoo medicine men surmised that she started acting up because she didn't like her new moccasins. However, the Chief Witch Doctor at Ogden disagreed. He said the problem was that the medicine men down on the line were not making sure the moccasins were matched in wear and tear and pressure air. The chief also smoked out a signal to check the forward leg closely for looseness in the joints and issued a supplemental T.O. prescribing correct tolerances.

Apparently, the medicine men have heeded the chief's warning because there have only been about five "Watusi" incidents since September. However, she may be hibernating, and if the braves relax and sit back and smoke their pipes the "old gal" will break loose and really give some unsuspecting pilot a real go-go. This emotional gyration is extremely hard on the hearts of our aging crewmen.

Maj Donald R. O'Connell
Directorate of Aerospace Safety

INCREASED FLYING hour programs, full training schedules, heavy, mixed ordnance loads and rapid turnaround times are all imposing backbreaking requirements on maintenance and armament people.

This situation has been well publicized and those agencies charged with improving it have programs in being. In the interim, however, commanders must impress their pilots with two vital safeguards for accident prevention. These safeguards are needed to supplement maintenance and armament efforts and to provide a double check.

First, the pilot's aircraft preflight must be even *more* thorough than in the past. More time and effort should be devoted to examining all necessary areas of the aircraft, especially the armament racks. After engine start, particular attention must be paid to temperatures and pressures to insure everything is in fact "in-the-green." It should not require much selling to minimize the "hurry-hurry" attitude during preflight. After all, the pilot's life does hang in the balance.

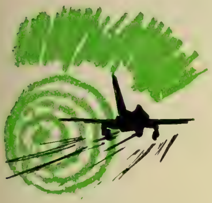
Secondly, discrepancies discovered prior to takeoff should be carefully analyzed. Normally, any departure from the desired parameters outlined in the technical orders is cause for an abort. Why take a sick bird into the air? The reading that may be only a little less or a little more than right—is wrong! Accident records often tell the story of the small problem prior to takeoff that seems to grow into a giant shortly after leaving the confines of the airfield.

A point to ponder: how many pilots have spent their last few mortal moments regretting the haste of a preflight or the reluctance to abort?

Lt Col Eugene P. Sonnenberg
Directorate of Aerospace Safety

U-3A ICING—Although the U-3A is restricted from known icing conditions, this is no guarantee that the bird won't ever pick up a little.

Last winter a pilot on final approach had trouble getting the nose up and recovered only by applying full power and raising the gear. Elevator control was regained only after repeated reversals of elevator control pressure by both pilots. Ice had built up on the leading edge of the elevator tip horn and restricted elevator travel. The clearance between elevator and stabilizer tip is only one-eighth to one-forth inch, so it doesn't take much to hamper elevator movement. In this case the binding was not evident until the gear was lowered and the aircraft began a rapid descent. Recommended action is to get on the power and raise the gear.



DRAG CHUTE PACKING—During the landing of an F-100D, the pilot was unable to deploy the drag chute until the handle had been pulled four or five times when the airplane was almost stopped. Inspection of the drag chute control system indicated that it was properly rigged. However, inspection of the drag chute itself revealed that the flap of the pilot chute bag which was over the pilot chute was torn and ragged. In an effort to duplicate this malfunction, the drag chute was repacked and reinstalled on the airplane. When the pilot chute pin was pulled, the pilot chute spring caught in the ragged flap and prevented the pilot chute from deploying. This incident illustrates the folly of using worn or defective equipment.

North American Aviation Inc
Operation and Service News

LANDING GEAR WARNING HORN CUTOUT BUTTON (T-39A, B). Many inquiries have been received concerning the use of the landing gear warning horn cutout button to test for proper operation of the landing gear warning circuit while the airplane is on the ground. This practice is definitely not recommended. The button should be used only for what it was designed to do, silence the horn, and here's why, accompanied by a bit of background information.

When the warning horn cutout button is pressed with the airplane on the ground, inflight gear warning operation is duplicated. That is, the warning horn sounds, the gear handle light flashes, and a pulsating signal is heard in the headset.

Pressing the cutout button when the airplane is on the ground allows essential bus power to be directed through the K580 landing gear warning horn control (LWHC) relay, through the K579 landing gear warning horn (LWH) relay, through the gear handle (position selector) pins "E" and "D", and through the gear handle warning lights to ground.

If one looks at the landing gear position indicating and warning system diagrams in the "T-39A Wiring Data and Diagrams," T.O. 1T-39A-2-8, it would appear that the K580 relay becomes energized, disrupting power to the horn and the intercom system, and that the K579 relay will not energize because of polarity being reversed. But quite the opposite is true. These are non-polarity-type relays. Normally in parallel, they are in series when the gear warning system is utilized as described above. The K579 relay incorporates a 500-ohm coil and will sense a sufficient voltage drop to become energized, However, the K580 relay, incorporating only a 200-ohm coil, does not sense a sufficient voltage drop to become energized.

In summary, the horn cutout button should never be used to ground-test the gear warning circuits because polarity on the K579 relay would be reversed and surges of excessive current flow would be imposed on the landing gear rectifier diode that could result in its subsequent failure.

North American Aviation Inc
Operation & Service News

Aerobits

F-105F KILLER ITEM. The F-105 man-seat separator is a valuable piece of equipment to the pilot. But to have this value it must be properly installed, properly rigged, and properly used. Otherwise it can become a man-killer.

The man-seat separator mechanism on the front seat of the F-105F has a small finger-like trigger that slides vertically in a track which is mounted on the right side of the bulkhead immediately behind the seat. During vertical seat adjustments this trigger slides freely up and down within the track. When the ejection seat is fired, the trigger travels upward with the seat and contacts a trip plate at the end of the track. As the seat continues upward the trip plate forces the trigger and its linkage downward which in turn fires the gas initiator located just behind the pilot's right shoulder.

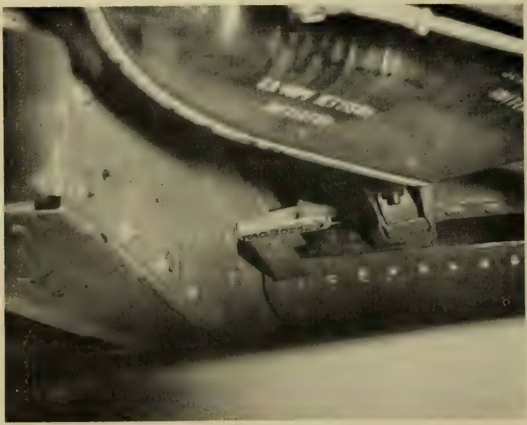
That's how it works if properly installed, rigged, and used. The accompanying photo shows one that was not properly installed or rigged. Notice the trigger (labeled RAC 10252-3) is on the outboard side of the track. Notice also that all further upward movement of the trigger has been stopped by the edge of the sheet metal adjacent to the track. *The piece of sheet metal now is serving as the trip plate* and on this particular seat, *a further upward seat adjustment of one-eighth inch or less would have fired the lap-belt and man-seat separator!!*

The real knee-knocker here is that this was the third flight on this bird since the seat was installed. Any one of the three pilots could have detected this item with a single glance.

Also, the egress system people may be completely innocent of any wrong doing. The design of the trigger allows it to rotate upward approximately 90 degrees to allow it to clear the trip plate during seat removal. But this same design could allow the trigger to be rotated upward and pulled out of the track unintentionally by a hastily retrieved map (the map case is immediately adjacent to this area), shave kit, or any other of a million items we pilots choose to stuff in a cockpit.

Our engineers are working on a fix but it takes time. There could be another out-of-track trigger in your squadron right now. And although this one is peculiar to the front seat of F-105Fs, it's well worth your attention unless you know you can hack a sudden full-forward-stick, three negative G maneuver at the outer marker!

Capt John F. DuPriest
SMAMA, McClellan AFB, Calif.



☆ U. S. GOVERNMENT PRINTING OFFICE 1966 201-214/6

WELL DONE

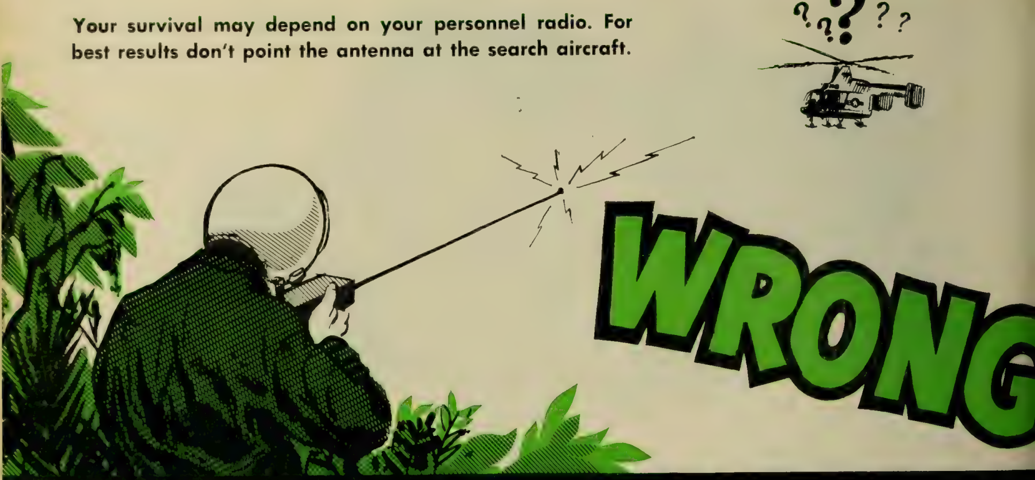
1ST LT. ROBERT L. SHEPHERD JR.

85 AIR TRANSPORT SQUADRON, TRAVIS AFB, CALIF.

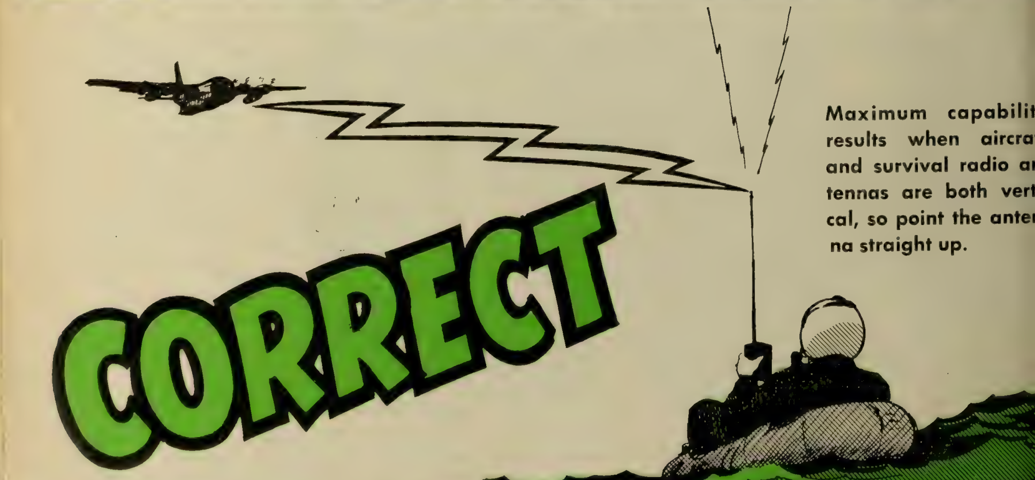
Lieutenant Shepherd and his crew departed Tainan Air Base, Taiwan, in a C-124 enroute to Tachikawa Air Base, Japan. During liftoff, Nr 2 engine backfired and power was reduced to 40 inches on that engine. The engine was scanned and checked during the climb and appeared to be operating normally. Power was restored and climb to level-off at 9000 feet was completed without further incident. Shortly after level-off, Nr 4 started backfiring severely and the scanner reported gray-white smoke coming from the cowl flap area. Lieutenant Shepherd ordered Nr 4 propeller feathered, and as it was being feathered, a rapid drop in oil quantity was noted by the engineer. Lieutenant Shepherd requested a change in flight plan to Taipei, Taiwan, where adequate support could be obtained. About 5 to 10 minutes later, the Nr 2 engine oil temperature started to rise with a drop in oil pressure. Nr 2 also had a loss in torque pressure and the oil temperature continued to rise. The rise could not be stopped, so Lieutenant Shepherd ordered Nr 2 propeller feathered. Lieutenant Shepherd obtained clearance to 5000 ft minimum enroute altitude for the airways and started a slow descent. During this time GCI radar was contacted and Lieutenant Shepherd made the decision to have "Stargazer" vector him to the nearest suitable landing field. A vector was given to Hsin Chu Air Base, 25 miles away, which had a 10,000-foot runway. Lieutenant Shepherd maintained a slow rate of descent and had the field in sight at 4000 feet, eight miles from Hsin Chu TACAN. In the descent, the two remaining generators started to overheat. Lieutenant Shepherd had already turned off all unnecessary electrical equipment but it was not until passing 3000 feet that the auxiliary power units would come on the line. Below 4000 feet, GCI control was lost due to terrain features. Lieutenant Shepherd elected to continue the slow descent VFR, doing a 360-degree turn to lose altitude, and placed the aircraft on a proper final approach. He made a full flap VFR night landing without further incident. A check on the ground revealed both Nr 2 and 4 engines to be frozen, an indication of complete internal failure. Lieutenant Shepherd's sound decisions and prompt action on the part of the crew prevented the possible loss of several lives and a valuable aircraft. WELL DONE! ★

SURVIVAL RADIOS

Your survival may depend on your personnel radio. For best results don't point the antenna at the search aircraft.



POINT ANTENNA UP



Maximum capabilit
results when aircra
and survival radio a
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na straight up.

629.1305
FLYS

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SAFETY
UNITED STATES AIR FORCE

APRIL 1966

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SAFETY

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AFRP 62-1 APRIL 1966 VOLUME 22 NUMBER 4

FALLOUT

SNOW GUIDE

I have just read the article, "Snow
Guide," in the February issue, and I believe
there are several comments worth adding
to safety precautions for snow remova
equipment operators.

a. It is imperative to have a signal mar
stationed in a position where he can be
seen by snow plow or snow blower oper-
ators whenever equipment is being movec
into or out of a building or shelter for such
equipment. This base is now utilizing signa
wands such as those used for parking air-
craft. Signals are essentially the same a
those used for signalling aircraft. Snov
plow blades and blower assemblies limit th
view of drivers and therefore a signal ma
must be in place to assure maximum safet
to personnel and to prevent equipmen
from hitting obstacles.

b. A further word of caution concern
keeping vehicle cabs well ventilated. Sno
removal equipment, we have found, has t
stop runway operations for landing an
departing aircraft. Drivers may sit in th
vehicles for extended periods while engine
are idling. Whenever equipment or vehicl
engines are idling, keeping windows ope
may not provide enough ventilation. Equip-
ment or vehicles, when idling, should b
parked so that any prevailing wind cond
tions will blow exhaust fumes away fro
the cab.

c. This base does not have radio equip-
ment in snow removal vehicles and w
under no circumstances rely on signal ligh
from the tower. As a backup in the eve
of radio failure, the tower will flash th
runway lights on and off to signify clea
ance of the runway is required. This is al
used in addition to radios for any impen
ing aircraft emergencies requiring immed
ate runway clearance. We have at lea
one and usually two radio monitoring veh
cles that remain with our equipment whe
ever it is on the runway. These vehicl
have flashing red lights. Whenever th
tower requires the runway to be cleare
it notifies the control or monitor vehicle
These, in turn, immediately turn on the
flashing red light and travel the length
the runway. As the snow removal equi
ment operators see the flashing red lig
they clear the runway at the nearest
selected taxiways. The monitor vehicles a
the last to clear. They do, however, assu
the runway is not only cleared of vehicl
but of any obstacles that might ha
broken off and fallen from the snow
moval equipment. When the monitor ve
cle or vehicles clear the runway, report
made to the tower that the runway is cle
and the tower is told where equipment
holding. The tower will not direct aircr
into these areas after the aircraft h
landed. The monitor vehicles can rep
any windrows that may be remaining
the runway. The vehicles keep their fla
ing red lights on until they are once ag
cleared by the tower to return to the r
way. They then escort the snow remo
equipment back onto the runway. . . .

Lt Col Billy Burke
5010 Civil Engineering
APO Seattle 98737

Brigadier General C. B. Stewart, Director of Aerospace Safety, discusses some important aspects of . . .

THE SAFETY BUSINESS

IT would be easy for us in the safety business to present the facts to make a preconceived point. When we are telling others about how well we have done, we could discuss the rate decline, documented with impressive charts showing tremendous gains. When we wish to present the other side of the picture, we might discuss the thousands of people lost, compare accident losses to war losses, and point to specific disasters for dramatic emphasis upon the horror of accidents. It is not fitting that either of these approaches be taken. Rather, our responsibility demands that we take a sober, hard look at the situation as it exists and plot a course for future action.

Without attempting to determine whether past efforts have been excellent or inadequate, the point remains that at the moment the Air Force experiences approximately 300 major aircraft accidents a year, some missile disasters, and a tremendous number of ground mishaps which result in loss of life, money, materiel, prestige and national defense potential. If the trend established during the first month of this year were to continue, the gains in aircraft accident prevention for the past decade would be negated. The number of major accidents during January was double that of the same period a year ago. What is particularly distressing is that nearly all of them were preventable.

Now you've heard those words before, "It was preventable." In this case, however, not only were many of the accidents preventable, they never would have occurred if the individuals involved had observed the most elementary principles of safety.

We must face the reality that our exposure to accidents in the months ahead will increase for several reasons. Some of our safer aircraft, multiengine bombers, for example, are flying less, and fighters—where the accident rate has always been higher—are flying more. We are operating in an environment with greater risks. We are increasingly exposed to long, overwater flights, in many climates and under various weather extremes. Our aircraft are forced to carry heavier loads and more explosives. They are operating in and out of marginal airfields with maintenance under field conditions and in areas where navigational aids are sparse or even non-existent and ground

facilities are primitive.

Perhaps it is only natural to shrug one's shoulders and say that "this is war." But that attitude could be disastrous. The fact is that as the challenges increase so must our efforts. Some of the areas in which I believe we must concentrate are command emphasis on accident prevention, better training, greater proficiency on the part of each individual to increase the degree of his professionalism, better analysis of problems both old and new.

Taking these in order, we must begin with commanders. They set the tone within their organizations, and their attitudes and attention are reflected by those they command. It is not enough, as we all know, for a commander to merely say, "there will not be any accidents." He must lead and motivate his people in such a way that the entire strength of his organization is brought to bear on the problems that occur.

Training is one of his responsibilities; in fact, one of the most important. We should never have an accident because someone didn't know how to do his job—but we frequently do.

Professionalism is a product of training, experience and discipline. We pride ourselves on being a professional air force, yet too often we see signs that indicate a lack of professionalism due to the absence of one or more of the essential ingredients inherent in the term. Frequently we find that discipline is missing, be it organizational discipline, which is the responsibility of commanders and supervisors, or personal discipline, which all Air Force personnel who call themselves professionals must exhibit.

The Directorate of Aerospace Safety has many tasks and responsibilities in accident prevention. One of the most important is that of obtaining, analyzing and disseminating information. With an eye toward increasing our capability in this area, we have been studying the need for updating our data processing equipment. It now appears that in the near future we will be able to make significant improvements.

We have proposed a data system designed to produce better and more timely information for our managers in the accident prevention program. Primarily we seek an expanded data system for flight, missile and ground accidents, not only to increase the input but in our ability to handle the data; an automated Flight Record (AF Form 5); and an automated ground accident reporting system originating at base level.

We store a tremendous amount of information and data in the Directorate of Aerospace Safety; our goal is to make all of this more useful in the prevention of accidents. Analysis of this data and information will help us to identify the source of the problems that cause accidents.

But we need more than this: We need your help. Frequently I ask for suggestions as to where we should concentrate our attack. The results are very discouraging. Everyone agrees that there is a problem with many facets, but there are few suggestions as to a focal point of attack. Now I just can't believe that, with

* * *

the number of accidents that continue to occur, there aren't some important areas to which we have not given sufficient attention but which would yield great rewards if subjected to positive corrective action. That is why I am appealing to all of you at the field or command level. You see our problems from several different perspectives and the Air Force needs the kind of information which you can provide. In supplying this information, document it if you can; if documentation is outside the scope of your duties, at least let us know if there are any positive accident prevention ideas which you seriously consider have real potential. We in the Directorate are always open for suggestions. In this regard, I invite your attention to page 21, where you will find a discussion on a new use of an old technique. On the following page is a form by which you can express your ideas. I invite you to take this opportunity to put your ideas down, then send the form to the editor of AEROSPACE SAFETY magazine. I assure you each suggestion will be seriously considered. The result cannot help but be a better and safer Air Force.

C W Stewart

* * *

For The Record

Final 1965 aircraft accident rates are now available; the major accident rate comes out at 4.6 against 1964's 4.4. That the Air Force major aircraft accident rate for 1965 did not show a larger increase may come as a surprise, in view of the events in Southeast Asia during the second half of the year.

This cannot be accounted for by increased flying hours. In fact, total flying hours for the year were slightly less than the previous year. True, PACAF and TAC flew more hours, but several other major commands flew less. Possibly most significant is that a greater share of the flying was done in high risk aircraft—fighters and other tactical aircraft in an environment conducive to accidents.

Ground accidents were reduced substantially during 1965. Fatalities were down 20 per cent, in both traffic and non-traffic ground accidents. Most encouraging, perhaps, was that private vehicle accidents decreased 12 per cent and the fatalities in this type accident were reduced from 437 in 1964 to 352 in 1965. This reflects the continuing emphasis on eliminating the private auto as a killer. Obviously, though, much remains to be done, not only to make further gains but to hold the gains made.

Missile mishaps batted about the same average as in 1964. For the first time a leveling-off occurred. These mishaps had been increasing greatly each year through 1964.

The aircraft accident rate has remained approximately the same for the past three years, 4.4, 4.4, and 4.6. This may be discouraging to safety people, who can see so clearly that most, if not all, of the accidents which have occurred could have been prevented.

We're not so naive as to believe that we will have a zero rate this year or next year. Neither do we believe that we have to have a major aircraft accident nearly every day of the year. Let's see if we can't do something about that. ★

When the accident investigators arrived on the scene they were treated to a fine example of old-time . . .

WESTERN HOSPITALITY

Two modes of transportation for modern rancher. Al Mitchell in cockpit of helicopter he used to fly pilot of crashed aircraft to hospital 60 miles away. He used chopper, horse and truck to assist in locating pieces of aircraft.

The primary mission of the Directorate of Aerospace Safety is to prevent accidents, but try as we may, aircraft continue to crash. We know that about 300 aircraft will enter the records during 1966 as major accidents. And each of these must be thoroughly investigated.

At best these investigations are unpleasant. We have to deal with the wreckage of what was once a fine piece of machinery; often there are fatalities; many accidents occur in remote areas where facilities of any kind are meager and the weather frequently seems determined to make our job as nasty as possible. Nevertheless, we have to do our job and we accomplish the task to the best of our ability.

But once in a great while something downright pleasant occurs to remove accident investigating from the run of the mill. This happened to a group of accident investigators last January after the crew of an SR-71 had to bail out and the wreckage landed on ranch land in the remote, sparsely populated area north of Tucumcari, New Mexico.

Normally, we would not devote this much space in a safety magazine to material not directly connected with accident prevention. But this case is the exception because of the marvelous hospitality and cooperativeness extended to the Air Force investigating team by the people of Tucumcari and specifically two ranchers, Mr Albert Mitchell, Jr., and Mr Norman Libby, who live and operate huge spreads north of the city near Bueyeros and Mosquero. Al Mitchell is about 30 and an ex-airman who flies his own helicopter. His neighbor, Norm Libby, about 60, is an old-timer in the area and in the cattle business.

The accident occurred on the afternoon of 25 January. There were about three inches of snow on the ground and the weather was cold. But the story is a warm one and, we think, typical of the kind of western hospitality recounted in songs and verse about the Old West.

Norman Libby almost converted many of the Air Force accident investigators to ranchers with his hospitality.

Al Mitchell was removing a hot branding iron from the rump of a young colt when one of his helpers yelled and pointed to a pair of tiny specks high above the New Mexico desert. Mitchell took one long look, then headed for a hangar where he kept his small Hughes helicopter.

Moments before, the men had heard an explosion high over the long valley. They paid little attention at first, thinking it was a sonic boom, which isn't uncommon in this part of the West. It is generally known that the Air Force plans its supersonic flights over the less inhabited areas of the country so as to disturb as few people as possible. Then one of the men looked up and saw two parachutes gently descending and called attention to them.

Within minutes Mitchell had fueled the chopper while keeping an eye on the two parachutes. Moments later he was hovering over Bill Weaver—one of the men who had just bailed out of the world's fastest reconnaissance aircraft.

Weaver later made a detailed statement about the conditions surrounding his untimely departure from the aircraft, and his description of those sensations was delivered with the precision of an experienced test pilot. In reference to some of the details of his descent, he said, "I thought I must be dreaming. My hands were numb from the extreme cold and my face mask was frozen over 'til I couldn't see. Then for some reason I thought I heard a helicopter, but that was impossible in this desolate country, so I assumed maybe I was dead."

He couldn't have been more wrong. It *was* a chopper, and out stepped Al Mitchell. He collapsed Weaver's billowing parachute, unhooked his harness and placed a rock on the harness.

"He opened the face mask and asked me if I was all right. Right then I couldn't have been better," said Weaver.

Mitchell explained that he would "buzz" down a quarter of a mile and take a look at the other man, then he would be right back. But Weaver's navigator hadn't been so fortunate; he was dead.

Mitchell flew back to Weaver, picked up the heavily suited pilot and explained that he couldn't do much for the other fellow. Weaver, however, insisted that he see for himself, which he did. It was too late. Mitchell then headed for Tucumcari with his special cargo.

Fifty-eight minutes later they arrived in Tucumcari,

Libby shows Cannon AFB PIO Major Claude Burger where some of SR-71 wreckage landed.

Mr and Mrs Mitchell on walk in front of their ranch house. Her kitchen sustained a lot of hungry men.

WESTERN HOSPITALITY

where Doctor George E. Evetts, a busy young doctor there, looked Weaver over with the deftness of a seasoned pro, which he really is. He is the 66 Hq & Hq Battalion National Guard Surgeon and one of the busiest men in Tucumcari. He administered a mild sedative and let Weaver get some well-earned crew rest. Then, well on into the evening, he conducted a minutely detailed inspection of Weaver's navigator to determine why he apparently had made a successful descent from an extremely high altitude but had not survived.

Meanwhile, Libby had rushed to the scene of the crash and began fighting a prairie fire that had been ignited. He was busy at this when the highway patrolmen arrived.

About an hour after the accident Air Police began arriving at the scene with all the necessary gear for an extended operation. Officers and airmen from Amarillo AFB, Texas, and Cannon AFB, New Mexico, took over from a highly competent force of New Mexico State police, all of whom had performed their duties in a very professional manner.

The main part of the wreckage had fallen on Libby's land. When one of the Air Force investigators explained the importance of securing the area and keeping sightseers and souvenir hunters away from the scene of the crash, Libby went to work with a vengeance—after all, it was his property. After that there was practically no interference from the curious.

By nightfall the temperature was down to near zero and the force of airmen dispatched to the scene had increased to about 20 men. They had taken little time to gather rations for the mission, but Libby took care of that minor detail by returning from his headquarters about five miles away with hot beef, beans, potatoes, and plenty of coffee. Not only did he feed the troops that night, but for the Air Policemen on duty for the next four days, Libby was the greatest. They spent off-duty time getting a little well-deserved sleep at his ranch, and they were as well taken care of there as they could possibly have been at their own homes.

For the remainder of the week Mr Libby and Mr Mitchell and their employees spent hours helping the Air Force and Lockheed employees search miles and miles of the two huge ranches for the valuable equipment that was scattered over 15 square miles. When the weather was just a little too rough they were there with hot coffee and food. It would be difficult to estimate how many meals Mrs Mitchell served in her home or just how many hard-working, "dirty fingernail" boys were the guests of Mr Libby at the scene of the crash. Or how many hours Al Mitchell sat in his chopper flying from point to point to find minute pieces of equipment. The two MAC H-43 chopper crews said that throughout the day they kept a sharp eye out for Al as they performed their "square search" for essential equipment that would give the accident investigation team a clue as to the cause of the accident. If Al Mitchell wasn't in his chopper he was out in his pickup truck or on horseback aiding in the search.

Later the president of the investigating board spoke for all the Air Force men who participated. "Not enough can be said about what all that those wonderful people did during the week, but this should give you some idea: There were 105 officers, airmen and Lockheed employees gathered at the National Guard Armory in Tucumcari off and on throughout this period who will testify that they had never seen anything like it. Matter of fact, it was not uncommon to hear some of the young troops extolling the virtues of the ranch life over their own chosen profession. While we can't recall every name, we can say that just about everybody in Tucumcari helped in some way. The National Guard people were extremely helpful. They even went so far as to block off a street with sawhorses to make us a helicopter pad right near our headquarters.

"Now, here is the frosting on the cake. CMSgt Joseph R. Freshnock from the Amarillo AFB legal office, who had served so ably as our chief administrator throughout the week, made his final survey of the damage done to the ranches of Libby, Mitchell, and a Mrs Heimann. He submitted a short, two paragraph report which simply stated: 'No claims for damages filed by the owners of the property.' Those of us here at Norton, the crews at Edwards AFB, and the Lockheed personnel who participated in this unusual episode will testify to anyone who asks that it is certainly nice to know that people like those we met in Tucumcari, Bueyeros, and Mosquero, more than make up for some of the kooks that wave banners on campuses and street corners throughout the country." ★

FAA

ADVISORIES

Directorate of Aerospace Safety
Walter J. Wrentmore
FAA Liaison Officer

ABBREVIATED IFR DEPARTURE CLEARANCE. FAA Order Nr 7110.5 dated December 22, 1965, provides for the issuance of an abbreviated Air Traffic Control IFR departure clearance.

One of the most critical problems in the air traffic control system is the amount of communications time expended between pilot and controller. This problem becomes more acute, as more users utilize the system, and as more services are provided.

To alleviate this problem, the Air Traffic Service (ATS) has established various programs to simplify the ATC environment; e.g., preferred routes, Standard Instrument Departures (SIDs), eliminating of position reporting in radar environments, via flight plan route procedure. During the past year, some ATC facilities have employed other clearance programs designed to minimize congestion of departure communications channels. Study of these programs indicated that a standardized abbreviated IFR departure clearance program could be implemented.

ATC determined that the requested route in the flight plan as filed with air traffic control can be approved at the time of departure with little or no revision, providing:

- A pilot will have a copy of the filed flight plan or his company will provide the information on the clearance sheet.
- A pilot will not accept an abbreviated clearance if the flight plan filed with ATC has been changed by him before departure.
- A controller will not issue an abbreviated clearance if he is aware that the filed flight plan is subsequently changed by the pilot.
- The clearance as issued will be considered as a clearance to the destination airport filed in the flight plan.
- A specific SID, including a transition, if appropriate, filed by the pilot is considered part of the flight plan.
- The assigned en route altitude/flight level will be stated in the clearance.
- Abbreviated clearances will not be used with stored flight plans having prescribed "waiting period" until the time specified has elapsed.
- ATC can issue a detailed clearance at any time and will issue a detailed clearance when requested by the pilot.

To afford ATC facilities an opportunity to gain experience and to make any necessary adjustments, the program is being introduced in three phases. Phase one, air carrier operations, is to begin this month; phase two will add military operations, and phase three will include all operations. The dates for phases two and three will be determined by ATS.

Here's how the program will work in practice:

- When filed destination, route and SID, if any, will require no revision, the controller will state the phrase "cleared as filed," specify the en route altitude/flight level, and if required add any additional departure instructions or information including a SID.

Phraseology: CLEARED AS FILED, MAINTAIN (altitude); if required (additional departure instructions or information).

- When filed destination can be approved but filed route or SID will require minor revisions, the controller will state the phrase "cleared as filed," specify necessary revisions to the route or SID, specify the en route altitude and add any additional required departure instructions or information.

Phraseology: CLEARED AS FILED EXCEPT CHANGE (portion of route) TO READ (amended route), MAINTAIN (altitude); if required (additional departure instructions or information).

CLEARED AS FILED EXCEPT CHANGE (SID name) DEPARTURE TO READ (SID name) DEPARTURE, MAINTAIN (altitude); if required (additional departure instructions or information).

- When these do not apply, or when a pilot requests, a detailed clearance as prescribed in the Air Traffic Procedures Manual will be issued.

This order does not preclude the use of local agreements now in effect for specialized military training and flight test activities nor does it prohibit entering into additional local agreements for military training purposes and flight test activities, if an abbreviated clearance cannot accomplish the desired results. ★

F-4Cs of 389 Tactical Fighter Squadron on patrol during Alaskan deployment.

Never Excelled

Lt Col Norman H. Frisbie
Directorate of Aerospace Safety

389 TFS
NEVER EXCELLED

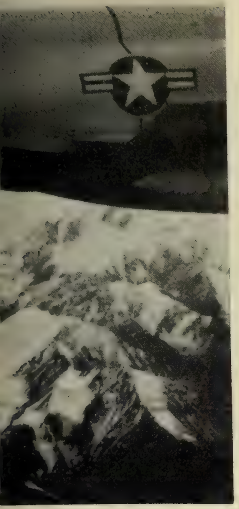
The F-4C assumption of the active air defense alert in Alaska was initially programmed for a wing that had been activated and manned with ex-F-102 and '106 pilots for that purpose. But due to the success of the F-4 in Southeast Asia and the pressing need for more fighters there, this wing was "zapped" over to the war soon after it was combat ready. This change in programming left only the 366th TFW to take the Alaskan alert. They were just receiving their F-4s and were in the early stages of converting from the F-84F.

The 366th had just received its last F-4 when, one month later, it was scheduled for a one-squadron ORI and a Preparation for Overseas Movement Inspection (POM). Two weeks later the wing was programmed for the deployment to Alaska, just before the heavy winter snows set in.

All went well for the 389 TFS, selected to take the deployment, but the strain of the rushed-up preparation of getting his squadron operationally ready far ahead of schedule took its toll on the commander, who suffered a mild heart attack. This left the squadron with a Major in command. Events were building up and pushing this squadron too far too fast. It was looking more and more like an accident looking for a place to happen.

The ORI for the 389th was highly successful. The air refueling and deployment profile, "nuc" and conventional weapons deliveries, plus the air defense intercepts, briefings after briefings, everything, went well—just like a bunch of pros. But this was dry and clear New Mexico, not the snow, ice, wet runways and the low ceilings of the far North. Also tests at Edwards on wet runways had just proven that the stopping distances in the F-4 Dash One were optimistic; several "old heads" could confirm this with practical experience. Then it was discovered, the F-4's were going to have to carry around-the-clock five minute alert at a northern Forward Operating Base (FOB) with only a 6600-foot runway. One or more major accidents looked like a sure thing for the 389th in Alaska.

However, a close look at the 389th would refute the gloomy picture described above. First of all, although new in the F-4 (average of about 160 hours), the aircraft commanders each averaged close to



2600 hours total time and an impressive 2000 hours jet time. Furthermore, they had been flying "super hogs" in the bad weather in USAFE for over a year. It was no wonder they did well in the ORI and deployments.

In Alaska they attended brief but thorough orientation lectures given by Alaskan Air Command people, flew some orientation flights around the state and in three days assumed two aircraft on five-minute alert with back-up at two remote sites plus the home base. The 389th maintained this alert at all times regardless of weather. At the same time, they participated in three Air Defense exercises flying 40 sorties in which they "zapped" every target assigned to them including those throwing chaff and max ECM. They also participated in two close air support exercises with over 40 sorties for the Army and received official letters of praise from the Army Commanding General for their outstanding performance. One close Air Support and one Air Defense exercise came simultaneously. Total hours flown in Alaska was 1889 in 883 sorties. This time does not quite match the remarkable record of the F-4 in SEA, but remember, all this was done in the worst weather in the world, particularly for the maintenance troops who were working to keep the aircraft in top shape. Also one third of the squadron was on five-minute alert at all times and could not be used for all this extraneous activity. Furthermore, and really impressive to the safety types, all this was done without an accident.

The deployment was not without its humor, "sporty courses" and fighter pilot antics. It wasn't 24 hours after arrival at Elmendorf before the Officers' Club Iron Man (full suit of armor) was mysteriously missing. Not too long afterward, the huge wooden F-102 hanging high on the 317th FIS hangar was missing. However, to the credit of the Base Commander and the 317th, these items were soon recovered and placed in their proper and permanent places.

The redeployment to the "southern 48" was truly remarkable and climaxed the entire outstanding job. In pitch dark, in a blinding snow storm, all 18 (100 per cent) of the squadrons' aircraft launched exactly to the second, on time and in the exact tail number order given two weeks previously! They culminated their deployment with an 18 ship fly-by at their home base, Holloman.

WHY SUCCESS?

Lucky? Well, who will deny that this helps any successful endeavor? But let's look at what helped old Lady Luck in the case of the 389th.

First, last and always, as usual, it was command and supervision. Although a heart attack cost one of the finest squadron commanders in the business and left only a Major in charge, that Major was "something else." He and his Ops officer were that old hard-to-beat combination, a good-guy squadron commander and a born leader with a super efficient, never-makes-a-mistake, hardnosed Ops officer. As you will see in the Why Success and Lessons Learned sections further down, these two used constant initiative, supervision and surveillance over every minor detail that could have caused an accident. They would have been blamed had they failed. Now they must be given credit for the success.

The 389th maintained over 80 per cent in-commssion status throughout the deployment which far exceeds the C-1 rating criteria. They could have excelled even that had the out-of-theater NORS (supply) rate been better. The maintenance was *outstanding* in every way. The spirit, morale and efficiency of the maintenance troops left nothing, but nothing, to be desired. Of particular note was the lack of troubles with the radar set. This was whipped by the A & E troops getting a debriefing immediately after each flight, getting on the discrepancy no matter how slight, and changing the black box, if necessary, all before the 66-1 process of getting a workload control number could be accomplished. This allowed them time and freed capability for scheduled radar maintenance and the big problems.

This outstanding maintenance effort sold everyone concerned on the benefits of squadron maintenance over 66-1 consolidated maintenance used in the "southern 48." Of course squadron leadership and superior support by the Elmendorf people made its contribution to that success.

IDEAL SUPPORT

Now let's look at one of the most unusual efforts of support ever seen by this humble author. The F-4's were integrated with the F-102's of the 317th FIS. That commander could very easily have "bad mouthed" the "super duper F-4" and built up his deuces. Or he could have just done nothing to help and he could not have been criticized severely. But instead he went out of his way to make the F-4 and the 389th look as good as possible.

Then, probably one of the most colorful and unusual Combat Support Group Commanders contributed immeasurably to the success of the 389th: The squadron's desire was his demand. In his organization that demand, without a doubt, also included ALL of his people. This included support all the way from keeping the bar open to maintaining a clean ramp, taxiways and center runway in the worst Alaskan snow season in years. He and his men truly did an outstanding job.

Then, too, Headquarters AAC and its commanding general were in all respects as cooperative as a higher headquarters could be. The Safety shop did more than its share

Never Excelled

in insuring support to prevent accidents. Again it was constant attention to details that made flying safer. The squadron safety officer had an excellent program that included all maintenance sections. His daily pilot briefing definitely contributed to the squadron's safety record.

Major Felix Fowler, 389th commander, discussing deployment with General Reeves, CINC Alaska (right), welcomed back to Holloman (left) by Colonel Obershain. All 18 aircraft that left Holloman returned safely.

LESSONS LEARNED

Two members of the squadron authored an excellent article in the *TAC Attack* on flying the F-4 in the frozen regions. Their wet runway and taxiing techniques could well be adapted by all F-4 pilots using short or wet runways. The McDonnell Test Section has emphasized this technique repeatedly in their service magazine and in briefings—that is, dissipate that energy by landing the airplane as it was designed! To a non F-4 "throttle jockey" it looks hazardous and very unprofessional, to say the least, to see that big bird slam on the runway with tires smoking, and nose gear immediately slamming down like a dead rhino. The VASI and GCA 2½ - to 3-degree glide slope will normally give you a good descent for normal wet runway landings. But at that short runway FOB the 389th used as much as an 800 ft/min descent to dissipate all of the landing roll that was practical on the initial slam-bang "touch" down. The 389th at all times used the published RCR and the Dash One stopping distances. Anytime the landing roll exceeded two-thirds of the available runway (or per AAC policy when it got below minus 30°F), they would cease all flying except active alert.

The squadron found the crosswind landing capability of the F-4 outstanding. They did not pull the ARI (aileron-rudder interconnect) circuit breaker as recommended by some pilots, but used normal Dash One techniques. They did find the Dash One charts overly conservative. They found that doubling the RCR with the given relative crosswind would work but never exceeded 35 knots. The following landings were documented:

Station	X-Wind	RCR	No. Landings
Main Base	24 knots	13	5
Divert Base	22	9	1
FOB #1	27	16	2
	34	12	2
FOB #2)the short one)	18	12	2

Although the snow removal program was outstanding, all the moisture could not be removed and in Alaska this means ice. So, on the landing roll, the F-4's would leave both engines running to get the aerodynamic braking of a windmilling engine until a point, such as 40 knots ground speed, were the residual thrust at idle overcame the braking effect, then they would shut down one engine. They would come to almost a complete stop before turning off the runway. The nose wheel steering was used sparingly and all taxi turns were planned for as large a radius and as slow a speed as possible. Intermittent max braking was used while taxiing. The 389th emphasized that it was impossible to taxi too slowly!

The maintenance lessons learned were considerable and existing published procedures were found lacking in many cases.

The hydraulic and pneumatic problems that occurred during the Cat II Cold Weather test did not materialize, largely due to forewarning. All hydraulic lines were re-torqued and checked constantly. This practically eliminated the leaks. The 389th would not reservice the pneumatic system prior to preflight because they found that running engines 20 minutes for warm-up would bring the pneumatic pressure up to standard.

The following areas received preheat prior to start:

(1) The CSD was preheated through the engine intakes to reduce wear on the unit and to permit earlier generator operation.

(2) The engine nozzle areas and teleflex cables were preheated through the auxiliary air doors.

(3) The cockpit area was preheated for two-three minutes before actuation of switches. This practice reduced cracking and deterioration of rubber seals and damage to components.

At temperatures below 15°F, the BLC indicator microswitch often sticks in the flaps-up position. Consequently, the BLC malfunction light illuminated momentarily when the wing flaps were lowered. This was easily recognized as an erroneous indication and did not cause mission aborts since the warning system continued to operate properly with the wing flaps retracted. Recycling the wing flaps several times usually allowed the hydraulic fluid to warm the microswitch area sufficiently to correct the malfunction.

The August '65 T.O. 1F-4C-1 lists

the maximum allowable fuel flow drop during engine runup as 50 pph with wing flaps retracted. This figure was often exceeded when the temperature was below 15°F.

When the CRU-60P oxygen adapter was subjected to cold soak, it became practically impossible to insert the oxygen mask hose. Under these conditions, it was necessary to retain the adapter on the oxygen mask hose. This procedure led to loss of emergency flow restrictors since the restrictor disconnected from the aircraft supply hose more readily than from the CRU-60P. Use of a small strip of suitable tape corrected this problem.

It was very difficult to strap into the cockpit while wearing arctic gear. As a result it required two well trained crew chiefs (one assisting each crewmember) to assist the aircrew in making a five-minute scramble from the alert ready room. The actual engine start/pre-taxi procedures consumed less than two minutes. Strapping into the cockpit consumed the remaining time. The leg straps presented a major problem. The leg straps were just long enough to reach around a muscular leg encased in even minimum arctic clothing. Almost none of the aircrew members would wear the heavy flying trousers. This problem produced constant nagging and was the worst gripe of the entire deployment.

The squadron found that the world-wide survival kit was inadequate for even short term survival in the arctic environment. In non-alert situations most crewmembers made up for most of the survival kit deficiencies by wearing the necessary clothing, stuffing the pockets, taping or tying items to the parachute harness and adjusting the cockpit temperature accordingly. The rapid reaction alert requirement placed practical limitations on both how much clothing could be worn in the alert facility or donned quickly and how much was compatible with the requirement for rapid strap-in and launch. Only minimum arctic apparel permitted the necessary reaction time. Consequently, they found it necessary to include the following items in the survival kit: Arctic type gauntlets, mukluks and socks, Arctic sleeping bag (a walk-around type was desired).

In order to get these items in the kit, virtually all items not essential to arctic survival were removed. The sleeping bag, suitably compressed, replaced the seat cushion.

The compass system was the only serious weakness in arctic operations. The slaved mode of operation, using either primary or secondary functions, did not provide reliable directional information in even mildly maneuvering flight such as 30-degree banked turns. Virtually all aircrews used the DG mode for departures and many used the DG mode for instrument approaches. The DG mode normally provided usable information. More data needs to be gathered on the compass system during any forthcoming programmed cold weather testing program.

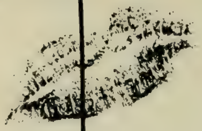
The inertial navigation system worked surprisingly well even at latitudes above 70°N. Accuracies were generally better than those experienced at Holloman AFB, possibly due to superb maintenance during deployment. This equipment is particularly valuable in the Alaskan theater since its large expanses of territory are not served by TACAN facilities.

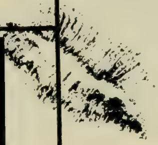
False starts became increasingly prevalent as temperatures dropped. It was theorized that moisture was freezing on the igniter plugs and reducing spark intensity to the point where fuel drowned out the plug. To correct this problem, igniter plugs were dry fired on aircraft preflight and ignition buttons were depressed at six per cent rather than ten per cent to ensure that the igniter plug fired before excessive fuel entered the chamber. The false start was virtually eliminated through these procedures.

In summary it was a job well done and only made possible to this extent by outstanding squadron leadership and typical professional TAC crews assisted by unusual support and exceptional maintenance. It will be some time before a deploying fighter organization in Alaska can refute the 389th motto—NEVER EXCELLED! ★

F4-C flight line at Elmendorf AFB, Alaska. Squadron gave much of credit for their success to local support.

KISS OF DEATH





Lt Col Eugene P. Sonnenberg
Directorate of Aerospace Safety

Normally most of the safety effort emanating from every level, Headquarters USAF down to the squadron, is aimed at people, planes, units and things that have been bedeviled by a series of mishaps—those unfortunate few suffering from a high accident rate are always a ready target for a safety pitch. But the words of wisdom that follow are not directed at the accident *prone*; they are primarily for the accident *free*. If your command, air force, air division, wing, group, squadron or detachment is expecting a reward for your outstanding safety record this year, take heed. This goes especially for organizations that expect to be first in line for an Annual Flight Safety Plaque.

During a recent discussion with one of our most successful fighter commanders, I mentioned the fact that his outfit was doing quite well safetywise this year. Before the words were completely out of my mouth, he blurted out, "Don't ever mention how good my unit's safety record is, and, please, don't send me one of your safety plaques; that is the 'kiss-of-death'."

I was shocked! Someone that really didn't want a coveted award? Superstition?

He continued: "It seems as though whenever an outfit enjoys an accident-free period, then receives and hangs a safety plaque, the roof falls in and a series of accidents occurs. I can't explain it, and I don't think anyone else can."

Unfortunately I was caught somewhat off balance, and wasn't really able to counter the commander's blast. But after some quiet thought and an examination of some accident histories, a very simple explanation occurred to me as to why an accident-free unit, or one recently awarded a Flight Safety plaque, can overnight change into a wreck-ridden nightmare for a completely befuddled commander.

The answer is summed up in that much belabored word—complacency. With a clean accident record as their goal, the commander, safety officer, pilots and airmen simply relax for awhile after fighting a winning battle against accidents for a year or more.

Here is where a unit can go wrong. The objective should not be accident prevention; the commander who makes this his goal probably won't be around to receive the safety plaque because his unit, led toward a false goal, may never have reached that elusive peak of effective mission capability.

On the other hand, the commander who sets his sights on his organization being the most effective, professional and efficient group in the business, and who then leads his people toward that goal, probably will wind up with a safety plaque on his wall. And he'll be able to keep the momentum going because his goals are realistic and reflect high standards that inevitably lead to operational readiness with safety as a highly prized byproduct.

His people are not motivated toward a goal that, once realized in the form of an award, is almost sure to produce a letdown. Rather, they are job-oriented and the satisfaction of top job performance, among operations, maintenance and support people, will assure an effective, task-oriented organization capable of producing a quality product—safely.

The commander who has *himself* and his people "up" for an award very possibly, on its receipt, may begin to ease off. Signs of this letdown begin to appear. The commander may fail to take action when a weak or potentially dangerous pilot is identified, permit irregularities on the gunnery range or tolerate unauthorized ACM. We know from experience that a commander's interest (or disinterest) in safety is contagious. When he lets down, others quite often do likewise: The FSO permits postponement of a monthly flight safety meeting or scheduled safety survey. Pilots perform cursory preflight on their aircraft and accept aircraft that are really not ready for flight. Airmen, especially the overworked and too often unrewarded maintenance men, forget to use the torque wrench or fail to refer to the T.O. for an involved task. Before one can say "thanks for the award," safety awareness has decreased and accidents begin to happen.

The difference between the accident rate of an outstanding fighter organization and the rate of one that spends most of its safety effort digging in crash holes is quite small. Ordinarily, F-100 wings will break even with the F-100 USAF rate if they have three major accidents in a year. Obviously one or two potential accidents that are saved by good pilotage or inspection or command action cuts the rate in half. Attention to, or neglect of, one or two details often is the difference between the also-rans and the winners.

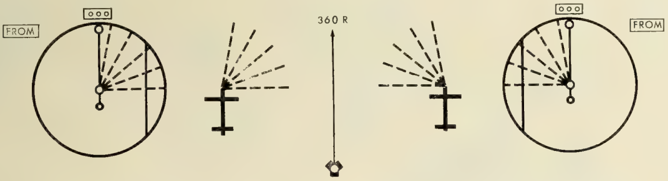
Aggressive drivers win: nice complacent guys lose. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

NEW PROCEDURES FOR AN OLD INSTRUMENT

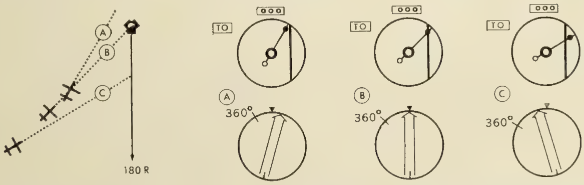
Just because the Course Indicator (ID249, ID351B, etc.) has been around for many years does not mean that procedures for using it cannot be improved. You will note in the new AFM 51-37 a different approach to course interceptions using the Course Indicator. Here is how these procedures were developed. First, let's look at *outbound* course interceptions.



As you can see from the diagram, three criteria must be satisfied in order to establish an outbound intercept angle.

1. Desired course set in course selector window.
2. FROM shown in TO-FROM indicator.
3. Heading pointer in top half of the Course Indicator and pointing toward the CDI (course deviation indicator).

Similar criteria are used for *inbound* course interceptions except the TO-FROM indicator must show TO, and the RMI (Radio Magnetic Indicator) must be cross-checked. Note the three situations listed below.



With no wind involved, the aircraft in situation A will intercept course beyond the station, and in situation B will intercept over the station. Only in situation C will the aircraft intercept course prior to reaching the station. In situation C the bearing pointer is between the selected course and the top index of the RMI. This latter relationship becomes the fourth requirement for inbound course interceptions.

Thus the basic criteria for inbound course interceptions are as follows:

1. Desired course set in course selector window.
2. TO shown in TO-FROM indicator.
3. Heading pointer in the top half of the Course Indicator and pointing toward the CDI.
4. Bearing pointer between top index and desired course.

When using the Course Indicator you should consider the heading pointer as being your aircraft. As you turn the aircraft to the left, the heading pointer moves to the left (counter-clockwise) and vice versa. Merely turn the aircraft (heading pointer) in the shorter direction to establish the desired intercept angle. Remember—cross-check the RMI when performing inbound course interceptions, and make sure the bearing pointer is between the top index and desired course when established on your intercept heading. ★

Rex Riley CROSS COUNTRY NOTES

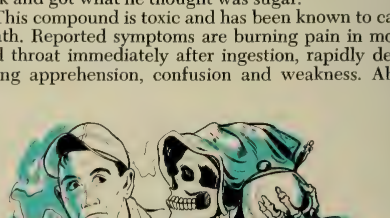
TRYING TO KEEP up with all the little things that cause trouble is like a three-legged cat attempting to corral four mice. But as these seemingly minor problems are brought to Rex's attention he'll report them in the interest of safety.

A crewmember recently suffered a burn on his cheek from acid that had leaked out of a flashlight battery into his oxygen mask. The flashlight had been stored in the man's helmet bag.

This may not seem to be exceptionally serious, but what if this were a pilot flying alone and somehow the acid got into his eye? Ever try to make a one-eyed landing? . . . at night? . . . in poor weather?

A FLIGHT engineer unknowingly drank poison the other day and became very ill. He mistook an unmarked packet of latrine deodorant for sugar and put it in his coffee. This deodorant, light blue in color, comes in small packets similar to individual sugar servings. Some of these packets went aboard the aircraft in a brown sack containing paper towels, soap and other items. The inflight kitchen also uses brown sacks for sugar, cream and spoons. The bag containing the deodorant was stowed in the buffet area. The engineer failed to turn on the light, reached into the wrong sack and got what he thought was sugar.

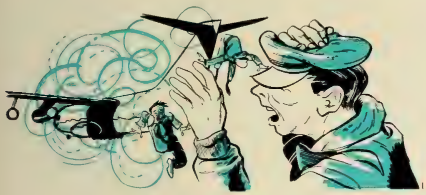
This compound is toxic and has been known to cause death. Reported symptoms are burning pain in mouth and throat immediately after ingestion, rapidly developing apprehension, confusion and weakness. About



the only antidote aboard an aircraft would be milk in the flight lunches, which should promptly be given to the victim. Also the use of artificial respiration and oxygen may be indicated. Meanwhile, the aircraft should be pointed at the nearest airfield where medical assistance can be obtained.

This product was a local purchase and was not properly labeled. If there are any such unmarked packets available for use in trip kits they should be discarded or properly labeled. Furthermore, sugar packets should be labeled as such.

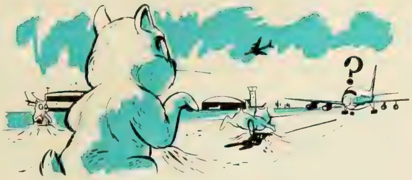
Action has been taken to prevent recurrence of this incident. But any unmarked "Sugar" packages should be carefully checked before dumping into one's coffee.



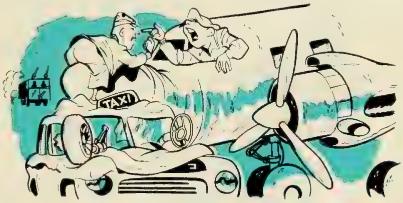
LACK OF courtesy on the part of a pilot not only caused discomfort to another crew but subjected an aircraft to possible damage. The following is a slightly edited quotation from an OHR reporting the incident:

"I and my crew were awaiting transportation from our C-133. We were standing in front of the aircraft with our luggage when transient alert brought in a C-141 on a taxiway perpendicular to the intersection to within 50 yards of our position. The C-141 then negotiated a 180 turn in this area and during this maneuver his blast whipped us with sand, dirt, dust and many sharp pea-sized gravel fragments from the shoulder and taxiway. The cloud of debris lasted for a full 30 seconds and also pelted the C-133 up to the engine air intakes. I approached the aircraft commander after he had sandblasted my crew and aircraft. He claimed not to have seen either us or the aircraft. He displayed complete indifference to the act and stated 'It takes power to turn an aircraft, you know.' I feel his disregard for other aircraft and personnel is inexcusable. I advised the next aircraft commander in the stage who said he would have the air intakes inspected for sand and gravel on his preflight. The ACP duty officer also was advised of the incident."

REX DEPENDS a lot on people who alert him to potential problems and developments that he can share with others. For example, a problem recognized by the 928 Troop Carrier Group at Chicago's O'Hare International Airport was passed to Rex by the parent organization, CONAC Headquarters at Robins AFB, Ga.



The problem is that civil airports do not report runway condition in the same manner as the Air Force. At O'Hare, for example, the RCR coding that USAF pilots are familiar with is not used. The condition of the runway is taken by civil authorities and reported to the tower and Joliet FSS. You can get it from the weather sequence, the tower, an FSS or from the automatic terminal information service which is broadcast continuously. In lieu of the Air Force RCR coding, pilots will get something like *Good, Medium* or *Poor* runway condition and will have to interpret it for themselves.



WHEN A TAXI accident occurs the pilot is more-often-than-not the one who gets a rap on the knuckles. Frequently, however, he is ably assisted in causing the mishap by equipment improperly placed and by helpers on the ground. Here's what Rex means:

- When the aircraft taxied into the drag chute drop area, the pickup crew was already in place. During the maneuvering the aircraft wingtip struck the truck used by the pickup crew. This mishap was the result of the truck being parked too close to the taxiway; the helper using hand signals for chute drop that were mistaken for clearance to taxi; the pilot failing to insure that he had sufficient clearance between wingtip and truck.

- Another aircraft was taxied at night into a loading van when the pilot departed from the correct taxi line. This was caused by floodlights that partially blinded the pilot; confusion as to the correct taxi line (a new line had been painted and the old one blacked out, but the old line was still visible in places); lack of experience on the part of a wing walker.

There's really not much excuse for these mishaps. Safe movements on the ground result from good teamwork and every man doing his job correctly.

Stacked With Statistics

Lt Col Merlin L. Chardi
Directorate of Aerospace Safety

The statistical figure 38—26—36 generally causes a certain degree of interest. Let's try to apply this same amount of interest to our air-launch missile statistics in the interest of accident prevention. In 1964, approximately 5000 air launches were accomplished throughout the Air Force for pilot and launch-crew proficiency training. During 1965, this figure increased considerably. With this increased operational requirement, we have had a proportionate increase in accidents and incidents.

	1964	1965
Accidents	5	10
Incidents	453	528

Fig. 1. Mishap Comparison

As indicated in Fig 1, there was a 17 per cent increase in mishaps, but there was also an increase in expenditures. An analysis of the 538 mishaps reported in 1965 shows that 123, or 22.9 per cent of all mishaps, were caused by personnel error and were therefore preventable. Materiel failure mishaps accounted for 376 or 70 per cent of the total. We will not actually analyze all of these materiel failure mishaps here; however the cause factors have been generally determined.

The majority of these mishaps are failures to guide, launch, or detonate. Now, once these vehicles are launched, they are really gone and we don't have any pieces or parts to look at! Therefore, it is assumed that they must have failed materially. NOT ALWAYS SO! From manufacture through storage—assembly—loading—to launching requires a great amount of human handling and testing. At any point along the line, an error can be made that would cause the missile to fail. It is in this area that commanders and supervisors can make the biggest gain in accident prevention. Let each of us consider these 376 "materiel failure" mishaps with a view toward preventing "people caused" materiel failure.

A comparison of statistics and cause factors of air launch missile systems for 1965 is provided in Fig 2 in order that each unit can compare its standard with the worldwide statistics.

Now that we have looked at some numbers and realize just how many accident and incident reports have been filed, what are some of the results gained from all of this reporting? Have we prevented an accident? Have we improved reliability? The answer is a definite YES. Let's just look at a few of the areas where good, sound investigation has pinpointed an unsafe act or part and what corrective action has been or is being taken.

Let's start with the AIM-9B early burst problems. First, there was the epidemic of motor blowups immediately after launch. An isolated case here and there would cause no great concern, but from a consolidation of reports, we noticed a trend. The engineering types went to work on the problem and found that someone had made a slight error. A TOC, a large "O" ring, some new glue, and strict adherence to assembly TO's—and we probably have several aircraft in the inventory that otherwise would have been lost!

Next came the contact fuze problem in the same weapon. This little jewel had a tendency to activate too soon—too often. Training launches were stopped. This solves one safety problem, but a fix was needed. The fix has been designed and is now undergoing live testing at the Naval Ordnance Test Station, China Lake, California. The retrofit should be completed by the time you read this article.

Then, a large pain developed in the "stomach" of the Bullpup. This came abruptly to the forefront when the missile started to fall apart after motor burnout. The cause was inadequate welding of the flanges in the wing coaxial antenna mating at the mounting bracket. A fix was promptly established. New brackets were soon stamped with the correct dies and the Bullpup was back in service. Guidance problems have always been with the Bullpup. However, these failures have been reduced by good investigations, monitoring, and follow-up actions. A two year monitor program has identified missile guidance and control components which have an increasing failure rate. Actions on these items should further improve the safety and reliability of the Bullpup.

The shape of things to come can be improved. If your unit's statistics are obese, your missile accident prevention program may need additional exercising. Improvement depends on the depth and scope of investigation by all. Let's improve the picture. 38—26—36. ★

Figure 2 (subject to revision)

Air Defense and Tactical Missiles	Total Mishaps	Personnel/ Supervisory Error		Materiel Failure		Undetermined and Other		Design Deficiency	
		Nr.	%	Nr.	%	Nr.	%	Nr.	%
AIM–9B	119	25	21	86	72.2	8	6.7	0	
AIM–7D/E	27	11	40.7	10	37	2	7.5	4	14.8
AGM–12B	255	37	14.5	198	77.7	11	4.3	9	3.5
AGM–12C	10	3	33.3	6	60	1	10	0	
AIM–4	54	14	25.9	38	70.4	2	3.7	0	
AIM–26	14	11	78.6	3	21.4	0		0	
ATR–2A	16	3	18.7	13	81.3	0		0	
ADM–20	2	0		2	100	0		0	
AGM–28	41	19	47.0	20	49	1	2.0	1	2.0
TOTAL	538	123	22.9	376	70	25	4.6	14	2.6

Drive To Live

Goodyear Tire and Rubber Co

During the past five years Lowell Roseborough has driven a half a million miles on public roads and highways. He has never had an accident.

As a test driver for Goodyear, Roseborough drives approximately 400 miles every working day. Last year his total was close to 90,000 miles, giving him an accident exposure roughly eight and a half times that of the average motorist.

Roseborough is typical of the 150 men employed by the company as test drivers. Last year these men drove 12 million miles, in all kinds of weather, day and night, on all kinds of roads, and recorded only 33 minor accidents—19 of which were encounters with wild deer.

During his years as a professional test driver, Roseborough has developed a manual of tips for the holiday-bound motorist who seeks safety on the highways.

• FASTEN SEAT BELTS. Repeat — fasten seat belts. Do this and sudden stops won't throw you forward. You'll keep yourself protected by the steel car body in case of collision and prevent the deadly chance of being thrown from the seat to the street.

• DON'T TAIL-GATE or hug the car ahead. Give yourself ample room to stop—and besides, the driver ahead probably takes a dim view of your togetherness.

• SWITCH TO LOW beam lights when another car approaches or passes you. Courtesy goes a long way toward preventing accidents.

• GUARD AGAINST FATIGUE, especially at night, by driving shorter distances with more frequent stops. Don't try to set long-distance records. When you get drowsy, pump your lungs full of fresh air, or pull over and exercise.

• CHECK THE CONDITION of your tires—as you would your shoes prior to a long hike. How's the air pressure? Under-inflated tires will heat up faster. Also, be sure luggage weight is equally distributed in a roof carrier. Your tires will thank you.

"Defensive driving" is practiced by all Goodyear test drivers, Roseborough said. Defensive driving is the ability to avoid accidents despite wrong actions by other drivers and despite adverse driving conditions.

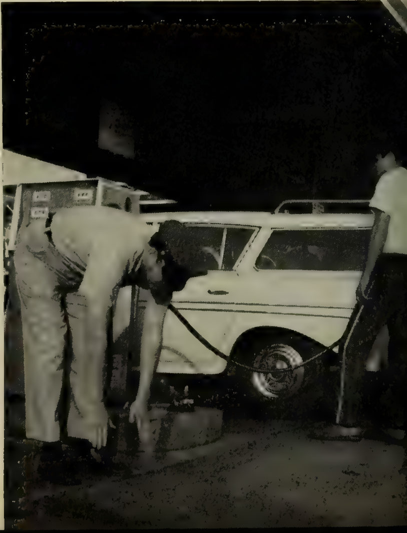
"It's an attitude of mind. I try to accept things as they are, instead of getting all broken up about what the other driver might be doing that's wrong—or fighting a sudden change in the traffic flow or the weather," he explained.

Roseborough and his fellow Goodyear test drivers gather this wealth of driving lore as they pilot all major makes of cars to prove the engineering advances in their companys' tires, determining durability and comfort, as well as safety.

What does family man Roseborough carry in his own car to survive highway combat?

"I make sure the spare tire is fully inflated and all tires are ship-shape. You'd be surprised at the number of motorists we see who are stranded in the middle of nothing without the tools to change a tire."

Roseborough also carries a spare sealed-beam headlamp, a small fire extinguisher, flares, flashlight and a first-aid kit.



TAKE YOUR DRIVING TIPS FROM THE PROS

Included below are most of the items that professional drivers—like Goodyear's test and fleet drivers—check before a trip. Can you afford to do less?

Mechanical Inspection

- Safe tires, properly inflated.
- Safe brakes and proper brake fluid level.
- Safe exhaust system, free from leaks.
- Steering mechanism operates safely.
- Cooling system is free from leaks, fan belt not worn.
- Windshield wiper blades are in good condition.
- All lights (including turn signals) operating.

Equipment for Trip

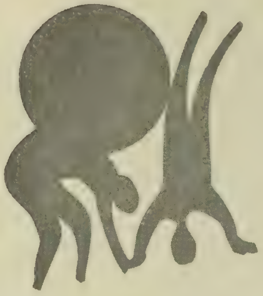
- Safety belts for all passengers.
- Flares and reflectors to set out in emergency.
- Properly inflated spare tire (check tonight).
- Auto jack and proper tire changing equipment.
- Emergency first aid kit.
- Flashlight with good bulb and batteries.
- Small, portable fire extinguisher.

Things to Do

- Get plenty of sleep each night.
- Exercise during driving breaks. Do deep-knee bends, jog around rest area, throw rocks from roadside.
- Keep cool. Open wing vents so air blows across face.
- Talk to someone during breaks (helps to stimulate mind).
- Eat lightly and drink coffee or cola soft drinks during breaks. ★

'ailgating (far left) is dangerous, often re-
s in many-car collisions, especially when
bility is poor. While car is being serviced is
od time to work out kinks in muscles to help
y alert on long drives.

Sgt. demonstrates three important safety factors: top, seat belts—fasten them; center, proper tire inflation provides cooler tire, better wear; bottom, first aid kit, signal device will be useful only if packed in accessible place in your car—not on shelf in your garage.



Capt Thomas W. Preston
3638 Flying Training Sq (Heli)
Stead AFB, Nevada

How long has it been since you were last directed to a back course ILS? Should this occur tonight, would you have any problems? Most Air Force pilots wouldn't have, but there are undoubtedly some who haven't executed this procedure in years and who may not be too sure of themselves.

Assume for a moment that you have to make a missed approach. You so state and the controller comes right back with, "Roger, continue through and stand by for a back course ILS."

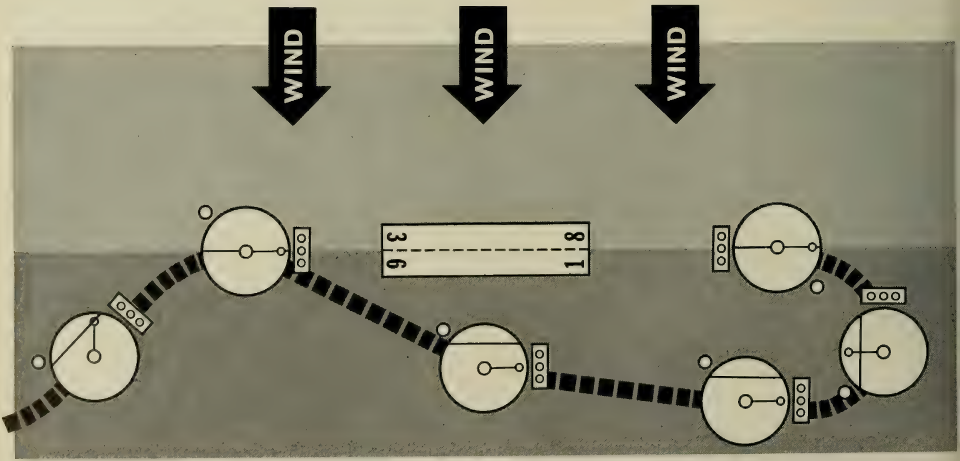
If this is likely to cause any confusion as to interpretation of the ID 249, read the brief words of advice that follow and study the illustrations. About five minutes or less will refresh your memory and possibly ease a little tension when, with the weather definitely sour, you hear ". . . back course ILS."

- Front course or back, set in the inbound front course heading with the Course-Set knob.
- Front course ILS or go-around straight-through, fly the heading pointer *toward the CDI* in the *TOP* half of the case.
- Back-course ILS or go-around straight-through, fly the heading pointer *toward the CDI* in the *BOTTOM* half of the case.

* * *

Want to practice "back-courses" in a leisurely manner? Dial in a VOR or TACAN station. Center the CDI and fly towards the station: set in the reciprocal of your track in the Course-Set window. Make all corrections in the bottom half of the case at a leisurely rate, as the instrument tells you 20 degrees of arc rather than the five degrees of arc on the ILS centerline.★

BACK COURSE ILS



Your Opinion, Please

Flying safety officers are generally pretty busy fellows, whether their time is occupied in digging around smoking holes in the ground or the more positive aspect of their job—preventing accidents.

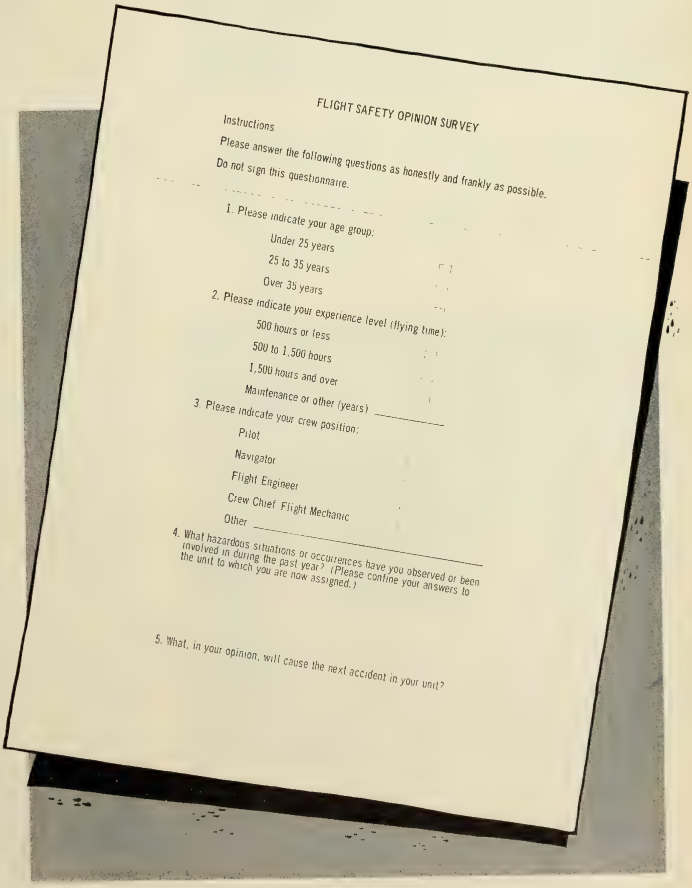
The point is: they need help. No FSO can prevent accidents all by himself, so it behooves every man in the outfit, from the commander on down, to help him. This can be done in many ways, but we're going to talk about just one here.

Surveys, or opinion polls, are old hat, but over the years they have been good tools for management in meeting the organization goals. How effective such surveys have been in the pursuit of safety we don't know, but we have been introduced to one that appears to have promise. It was developed by weekend warrior John Wells, and presented to the Directorate of Aerospace Safety as a possible means of preventing accidents. The questionnaire is quite simple but the questions it asks, when answered truthfully and with thought, can have far-reaching results.

Although designed primarily for the use of FSO's, the questionnaire could be adapted to eliciting information from other groups, such as maintenance personnel. Aerospace Safety is presenting it here for the use of any individual who feels that what he has to say can contribute to accident prevention. You may have to do a bit of substituting, e.g., if you work in maintenance, indicate years of experience in question Nr 2, and state your job under OTHER in question Nr 3. We realize that our distribution—one magazine per 10 people—will not provide a questionnaire for everybody. However, the form is being supplied to all Flying Safety Officers in the April-May FSO Kit and the FSO's can reproduce it. If you can't get one from the FSO, use a piece of blank paper. Just answer the questions and let us have your thoughts.

We assure you that each questionnaire received will get careful attention. We emphasize that this is not a gripe session, so please don't use the form for that purpose. What we're after are concrete ideas that can be translated into action to prevent accidents. No identification is wanted as to person or organization. We would like to have all the questions answered. When you've done this, mail the form to:

Editor, AEROSPACE SAFETY Magazine
Dep IG for Insp & Safety (AFIAS-E1)
Norton AFB, Calif 92409



FLIGHT SAFETY OPINION SURVEY

Instructions

Please answer the following questions as honestly and frankly as possible.

Do not sign this questionnaire.

1. Please indicate your age group:
   - Under 25 years
   - 25 to 35 years
   - Over 35 years
2. Please indicate your experience level (flying time):
   - 500 hours or less
   - 500 to 1,500 hours
   - 1,500 hours and over
   - Maintenance or other (years) ________
3. Please indicate your crew position:
   - Pilot
   - Navigator
   - Flight Engineer
   - Crew Chief Flight Mechanic
   - Other ________________
4. What hazardous situations or occurrences have you observed or been involved in during the past year? (Please confine your answers to the unit to which you are now assigned.)

5. What, in your opinion, will cause the next accident in your unit?

SURVIVAL ITEMS

SURVIVAL SLEEPING BAGS

The MC-1 survival sleeping bag may be just the item to warm up a cold survivor, but not if he can't get it out of the container. According to an EUR, tests conducted on several of these containers revealed that sometimes the wing nut fasteners are torqued so tightly that they can't be opened by hand. Tests by the unit submitting the EUR showed that the average man can exert four to six foot pounds of torque on a wing nut of the size and shape used on these containers. The forces needed to loosen some of the nuts ranged up to 10 foot pounds; seven out of 15 tested would have been impossible or extremely difficult fo a survivor to open.

The immediate fix by this unit was to fabricate a wrench which they tape to the container. This and a one-time inspection of the containers were recommended to the AMA. We don't know what final action will be but we'll try to keep you posted.

FLARE DISCHARGE

Normally small survival flares operate as advertised But occasionally they do otherwise so here's a bit o advice from the survival equipment experts.

When firing one of these flares, hold the flare gu well away from your face. Flares have discharge through the casing instead of the end. When you nee one of these flares you'll also undoubtedly have all th problems you need, so don't add a singed face or eyes

NEW RADIO BEACON

By now, or at least in the near future some ai crews will be equipped with the new URT-27 personal beacon. This little dandy is just that—little. It' about half the size of the URT-21 and designed t do the same job: attract rescuers to the user lik bees to a clover patch.

The set can be packed in seat or back pack parachutes and in seat survival kits. It can be operate automatically by parachute deployment or manually It's designed to operate at temperatures of 32°F t 130°F, and withstand 15 hours of salt water submersion, and the battery is supposed to be good for 2 hours continuous operation. During tests the signa was good up to 114 miles at 10,000 feet.

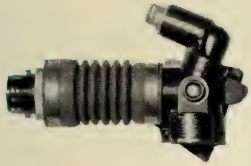
There have been cases in which survivors didn' know how to operate the URT-21 manually. The either didn't realize, or forgot, that the instruction are printed on a side panel, which is also true for th URT-27. Just remember that you've got to pull tha plastic plug to which the lanyard for automatic deployment is attached. Here are some other precautions:

- Remove flex antenna (when installed).
- Hold the antenna vertically.
- If radio set is wet, shake or blow water from bas of antenna.
- Keep hands, fingers, and tree branches fro touching any part of the antenna.
- During cold weather warm the radio by placin inside clothing next to the body.
- During hot weather keep radio in shade if possible.

The photos are of the prototype beacon. The pr duction item may have a slightly different appearance.

O^2 CONNECTOR

CRU-8/P mask-to-regulator hose connector.



CRU-60/P introduced new problems. Redesigned 60/P should be available by now.

Problems with the CRU-8/P connector from mask to regulator hose led to development of the CRU-60/P. The -8/P caused the hose on some aircraft to make a 90 degree turn at the connector and, consequently, an improper disconnect during ejection due to side loading. The -60/P was designed to eliminate this problem.

Then it was found that new troubles were introduced. Some of the new connectors had enough clearance between the parachute mounting plate and the mask connector to permit the shoulder harness to hang up during ejection. Redesigned connectors should be available by now, but if they aren't, aircrews are advised to make certain that the shoulder restraining harness strap is kept clear of the connector.

Since the CRU-60/P connector is replacing the -8/P on all aircraft with ejection seats, until the problems are corrected P.E. personnel should check for disconnect force and condition of the disconnect each time the oxygen mask is cleaned.

WARNING: Some pilots leave the connector on the parachute harness rather than on the mask hose. If one forgets to connect the mask hose to the connector a serious hazard will exist. Without the warning feature of the connector he might not notice that he is getting no oxygen until too late.

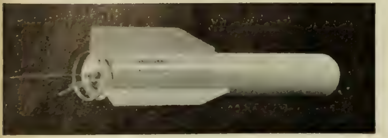
Here are a couple of stories about a couple of pilots who had experiences somewhat similar in effect if not in detail. Perhaps relating them here will turn on the red warning light in the minds of aircrews.

- During a day air refueling flight, the F-104 lost all cockpit pressure. The pilot was on 100 per cent oxygen. Then he noted that the blinker wasn't moving. He put the regulator switch on emergency but still felt no pressure in his mask. By now he was having trouble staying in formation; his hands were beginning to shake and he couldn't tell what position the 0^2 supply lever was in. He realized he was hypoxic so he pulled the green apple – still no pressure. He checked his hose but all connections were intact. Now he took a closer look and discovered the CRU-60/P hose was broken and held by only half an inch of rubber. That did it—down he went and straight home.

The hose was broken around the first accordion fold down from the connector. A check of other hoses showed that no amount of pulling or bending would break them but that a 180 degree twist would do the job. In fact, three hoses broke with only a 90-degree twist.

- In the second case, the pilot made a hooded climb to 35,000 feet, then turned the T-Bird over to the front seat pilot and lowered the hood. Cockpit pressure was 23,000 feet. After a few minutes the man in the rear removed his oxygen mask in order to blow his nose. Shortly afterward the man in front spoke to his companion but got no response. He then saw that the man was slumped over. He declared an emergency and made an immediate descent. As the aircraft passed through 17,000 feet, the unconscious pilot recovered and reattached his mask. ★

New URT-27 personal beacon is smaller than URT-21, can be packed in parachute or survival kits



COAST GUARD'S

NEW SAR TOOL

Lt J. F. Butler, USCG
U. S. Coast Guard Air Station
Salem, Mass

The U. S. Coast Guard is equipping its aircraft and SAR vessels with a datum marker buoy to aid in search and rescue operations at sea. The buoy is hand launched from the aircraft or ship to mark a distress position and act as a drift reference. It transmits a distinctive wailing tone on 275.1 MCS for use with UHF/DF and is capable of 36 hours of continuous operation. The 22 pound beacon is recoverable and will withstand repeated usage.

Following is an excerpt from the On Scene Commander's report on the datum marker buoy last September in the assistance of the tug *New Hope* 20 miles south of South Pass, Mississippi.

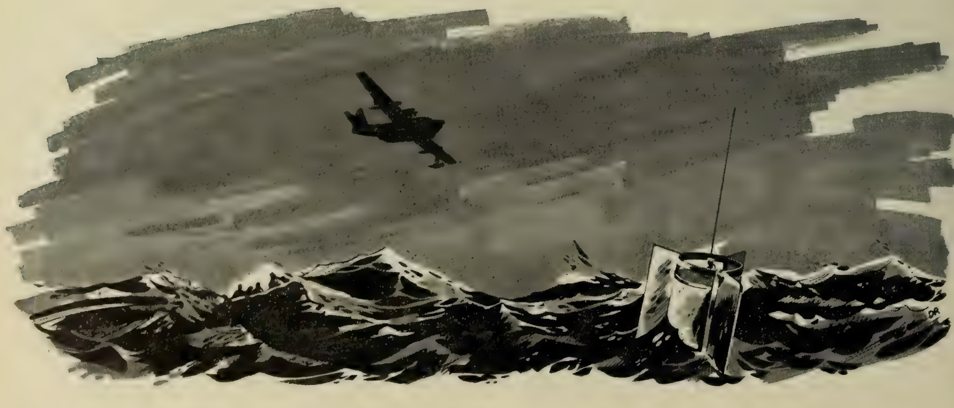
"After locating the New Hope, using ADF bearings and radar, a pump was dropped at 200 feet, and we were still IFR in heavy rain showers. The *New Hope* was visible only by a glow from her deck lights. Immediately after the pump drop the crew of the *New Hope* elected to abandon ship. While the deck lights were still visible the electronic datum buoy was dropped in the immediate vicinity, not right at the ship for fear of hitting the men, but within 300 to 500 yards.

"For the duration of the night we remained between 500 feet and 2000 feet marking the position with the datum buoy. Attempts were made to vector merchant ships to the scene using parachute flares, flying low over them and sending Morse code, but all attempts failed. At one point during the early morning we were as far away as 20 miles attempting to vector in a merchant vessel and were still receiving excellent bearings on the datum buoy from an altitude of 2000 feet.

"At daybreak the weather improved slightly and we were able to locate the rubber life raft with the seven men aboard, which was approximately four miles to the west of the datum buoy. The raft was then marked with smoke floats but, due to a large rain squall, was lost. After waiting 30 minutes and using the datum buoy as a reference the survivors were again located and their positions marked with smoke floats. The weather at this time was visibility three miles to zero in frequent heavy rain showers, ceiling 700 feet, winds 25 knots, moderate turbulence and seas 15 to 20 feet.

"Coast Guard helicopter HH52A 1372 was then vectored to the scene by myself and HU-16E 2123, who was my on-scene relief.

"It is my opinion that the datum buoy is primarily responsible for the saving of the seven crewmen's lives. Without it we would not have been able to maintain as close and accurate a position on the raft. The men probably would have been located eventually but with the buoy we were able to advise the helicopter that we had the subjects located and they felt confident in proceeding to the scene." ★



The Safety Concept......*from drawingboard to boneyard*

Major William T. Smith, Directorate of Aerospace Safety

Most Air Force personnel know of the diversified efforts by the Director of Aerospace Safety to promote safety throughout the Air Force and to seek out and eliminate potential hazards and accidents through the medium of safety surveys. Among the most frequent accident cause factors observed are errors on the part of people operating the equipment, failure of components not properly maintained, inadequately designed components which make an accident almost inevitable. Considering just the latter, it might be well to expound a little on what efforts are being made to correct this undesirable situation.

As a pilot, one grumbles frequently about problems with equipment and its operation, configuration or location, and wonders if anything is ever done to prevent recurrence. Yes, something is being done and this article will provide you some information on the subject of safety considerations from conception through production of a system. USAF Military Specification for Safety MIL-S-38130 provides contractors with a uniform guide with which to assess potential safety hazards in all systems and subsystems and analyze actions to reduce such hazards. In other words, System Safety Engineering is a prime consideration in the design, development, test and operation of systems and equipment. Complementing this specification is the Handbook of Instructions for Aircraft Designers (HIAD). This handbook provides the aircraft designer with comprehensive guidance which spells out in detail the design criteria for components or systems in an aircraft. The accumulation of a vast amount of experience over a period of several decades is reflected in many of the specific items listed in the HIAD, which serve as a checklist of those requirements for the aircraft designer that are necessary from the safety standpoint. This document reflects lessons learned so that repetition of previous design errors can be avoided. The handbook is revised quarterly to insure that it is both current and complete.

Subsequently, Preliminary Design Review, Critical Design Review and First Article Inspections are completed before using commands receive their first aircraft. Despite all these guides and the efforts of conscientious engineers, when a new aircraft is turned over to the Air Force, an exhaustive safety analysis frequently reveals that the system has a number of hazards already designed into it. For instance, some systems have been found to be conducive to accidents during maintenance or operation. Depending on the urgency of the situation, the using activity might have to live with a potential accident until retrofit action can be initiated, which is usually costly and time consuming.

Today we have the Systems Safety Review. It was developed in an effort to identify potential accident cause factors and initiate prompt corrective action. Its purpose is to correct deficiencies which are not readily apparent during the design or production states of a system, but which are recognized only after a certain amount of experience has been gained in the aircraft or the system. For example, cockpit lighting intensity or location might prove inadequate, fuel quantity gages misleading, problems with fuel sequencing or airstart ignition circuitry might occur. The host for such reviews is generally the Aeronautical Systems Division (ASD). Using commands, the Air Force Logistics Command, the Directorate of Aerospace Safety and all other interested agencies participate in this review on a limited scale. This is to keep representatives to a minimum and to preclude an unwieldy group which would interfere with achieving positive results. Ground rules are spelled out at the opening session and then personnel are assigned to working groups in their respective area of interest, i.e., aircraft controls, aircraft general, engine and fuel systems, armament, maintenance and AGE. Problem areas identified by using agencies, accident or incident reports, UR's or other means are categorized and assigned to a work group. The group considers each item on its own merits and then recommends corrective action. The group leader then reports back to the Systems Safety Review Board with recommendations which the Board subsequently assigns to the responsible agency for action. It should be emphasized that the items selected for immediate action are those which are considered potential accident factors. Therefore, part of the working group's responsibility is to ferret out those items that creep into the agenda and which do not directly affect safety.

In view of the guidance and System Safety Reviews cited above, it it apparent that every effort is made to insure delivery of the safest and most effective system possible. ★

Aerobits

HAZARD—Plastic bottles seem like such wonderful containers for re-use. One re-use that "appears" to be great is a gallon size for fuel for outboard motors, power mowers and the like.

At temperatures as low as 140°F., (which can easily be reached on a hot, sunny day in the trunk of a car) gasoline will readily permeate the polyethylene, especially where it is extra thin. Such containers are also combustible in themselves, and prone to cracking or rupturing when cold.

Lockheed Star-Rocket

FOUL AIR—After leveling off at 5000 feet, the pilot noticed that hot air was flowing through the cold air ducts of the A-1E. The cockpit was becoming uncomfortable so he cracked the left canopy slightly to get some cool air. After about an hour his vision began to blur with the result that he couldn't read his instruments, nor could he focus on the lead aircraft. Also he began to have a headache.

Somehow this pilot recognized his condition and suspected that he was suffering from carbon monoxide poisoning. He called Lead to advise of his condition and was told to open the left canopy all the way. This he did and after a few minutes he began to feel better and his vision improved.

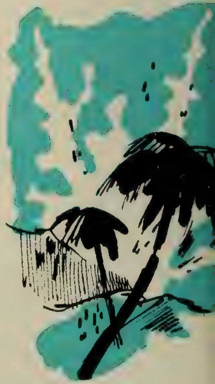
Later it was found that defective seals in the heating and ventilation system accounted for the hot air flowing through the cold air duct. The carbon monoxide resulted from engine exhaust flowing into the cockpit through the partial opening of the left canopy.

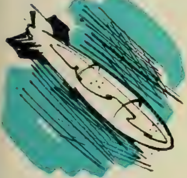
TARGET FIXATION AND PRESSING THE ATTACK—A flight of two A1-Es took off on an airborne alert mission. Lead was loaded with bombs and Nr 2 had napalm. The FAC directed the flight to hit a VC concentration in a wooded area.

During the subsequent pass, the Nr 2 aircraft struck the top of a tree and, although some damage was done to the engine, prop, engine cowling and other skin areas, the pilot successfully landed his bird at a friendly base. Subsequent investigation revealed that the pilot was distracted by excessive reference to the gunsight and failed to maintain adequate terrain clearance.

This incident is but one of several of this type occurring during the past year in fighter bomber aircraft. It shows that the age-old problems of target fixation, pilot distraction during the delivery run and/or pressing the attack are still with us. It's timely to state that a perfect score on the target isn't highly regarded if you also score a hit with the aircraft. So, plan your approach to the target; know the minimum altitudes at which you can release the armanent and still recover, and above all, don't spend all your time lining up the target, with too little regard for the onrushing ground. You'll live a lot longer.

Maj Frank J. Tomlinson
Directorate of Aerospace Safety





SLAM! BANG! The crew was installing signals in practice bombs. The job was progressing routinely until one of the crew had trouble screwing in the striker assembly—it was binding. When he applied more force, the striker plate broke loose from the plate extension because of a poor weld.

The airman then tried to remove the striker plate extension by hand but had no luck. So he took a real sensible approach to the problem—he slammed the bomb to the concrete floor. Result: the signal functioned and blew toward the man's face causing damage to both eyes.

CAT—Intensified research into the nature and causes of clear air turbulence will result from the creation of an interagency committee to coordinate government research into this phenomenon. The committee will seek to improve methods of CAT forecasting and detection devices.

The new group, the National Committee for Clear Air Turbulence, is composed of representatives from several agencies, including, DOD, FAA, NASA, Departments of State and Agriculture, National Science Foundation and the Environmental Services Administration (ESSA) of the Commerce Department. Major Gen Jack J. Catton, Headquarters USAF, will serve as committee chairman.

SWOOSHHHH!—After completion of refueling, a KC-135 initiated climb from 31,500 feet to planned altitude of 39,000 feet. Passing through 33,000 feet the copilot reported his side window was cracking on the inner pane and bits of glass were falling into the cockpit. The throttles were retarded and a descent started.

The aircraft commander had worn his helmet and oxygen mask during refueling and was still wearing the helmet, with 0_2 mask attached at one side. The copilot put on his helmet (unstrapped) and oxygen mask and leaned over the throttle quadrant to be as far as possible from the window and still be fastened in his seat by the seat belt. Shoulder harness was not fastened. The pilot did not depressurize the aircraft because the Boom Operator was in transit from the boom pod to the cockpit cabin.

At the instant the throttles were retarded the copilot's sliding window ruptured and departed from the aircraft. The copilot was forced through the open window by the explosive decompression. His body protruded out of the aircraft to about the lower portion of the rib cage. His back was against the aft window frame and his arms and hands were extending into the slipstream.

The navigator, who had put on his helmet and oxygen mask at the pilot's notification, proceeded forward and attempted to pull the copilot back into the aircraft. Airspeed had increased in the descent to approximately 300 KIAS, and the navigator was unsuccessful in his attempts. The pilot then leveled off and began a steep climb at which time the copilot was successfully pulled into the aircraft.

Approximately 30 to 60 seconds elapsed from the time of initial cracking of the window until explosive decompression. It is estimated that the copilot was outside the aircraft for two to three minutes. Altitude at the time of the explosive decompression was approximately 33,500 feet. Altitude at the time the copilot was returned to the cabin was between 20,000 feet and 22,000 feet. The copilot's helmet, oxygen mask and glasses were sucked off by the wind blast and the mike cord, part of the oxygen hose and map light electrical cord were torn from the aircraft.

The copilot was left in the seat and protected from the wind blast by a parka placed over him. After landing he was taken to the base hospital for treatment of severe frostbite of the hands and face.

Lt Col J. D. Oliver, Jr
Directorate of Aerospace Safety

Aerobits

BARRIER LIGHTS—During takeoff at night the pilot of an F-4C felt a slight yaw but nothing else so he continued the flight. A short time later, a tire was found on the runway. On the possibility that the tire was from the F-4, the pilot was notified. He played it safe and planned to land at a base where F-4C's were located – Holloman – and make an approach end arrestment.

The base was notified and preparations were made for the landing. Vehicles were placed so that their lights would illuminate the overrun touchdown area and a successful approach end arrestment followed, with only minor damage to the aircraft. Later the pilot said that he lost sight of the headlights on final approach but that he could see the rotating beacons on the vehicles at all times and that they made an excellent reference for touchdown.

Barrier markings are covered in AF M88-14, but there is no reference to providing lighting to enable a pilot to judge proper touchdown point during night approach end engagements. With the increasing number of such landings, it would appear that action on this should be taken immediately.

FAT BOOMS?—Kudos to an alert Safety Director and OHR-oriented KC-135 tanker crews at a northeastern SAC base. Tankers from this unit had reported occasional brute force disconnects while refueling TAC F/RF-4C aircraft. Out of the clear blue came a deluge of 55 reports of brute force pullouts while refueling these aircraft. A major inspection of KC-135 IFR systems involved revealed no maintenance problems. Moreover, this unit appeared to be the only one reporting this particular difficulty.

The finger of suspicion wagged from higher up, along with the accusation that KC-135s involved had "fat booms." An investigation of the receiver mission at the time of the reporting of the brute force incidents, revealed the receiver aircraft were brand new and were being delivered direct to operational units from the factory with aerial refuelings scheduled enroute. It should be recognized that rarely did a brute force pullout occur between a KC-135/RF-4C when the receiver had been assigned to an operational unit for a period of time.

As it turned out, the problem wasn't "fat booms," but a sticky relay in the RF-4C receiver aircraft. TAC had discovered this malfunction on quite a few of the RF-4Cs received from the factory, and had corrected it locally. We understand that the factory is now correcting the problem prior to delivery. We are fortunate that this story has a happy ending and no major losses occurred, although one TAC troop in an RF-4C over the Pacific pulled off the boom, leaving his refueling receptacle bent in a vertical position. After a little pucker time, he landed his bird safely.

It is difficult to believe that this KC-135 unit was the only one having brute force disconnects with F/RF-4C aircraft. One thing fairly certain is that they were the only ones reporting this condition. AFR 127-301, Reporting of Operational Hazards, defines an operational hazard as ". . . any condition or act that affects or may affect the safety of Air Force aircraft or associated personnel." There may be a few grey areas in separating a materiel problem from an operational hazard, but let the safety people distinguish the difference AFTER you submit the OHR. 781 write-ups don't always hack it.

Capt Robert A. Whitener
528 Bombardment Squadron
Plattsburgh AFB, New York

U.S. GOVERNMENT PRINTING OFFICE 1966 201-215/7

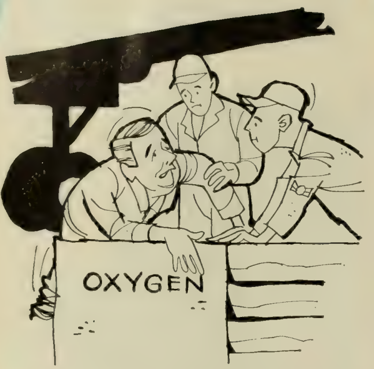
WELL DONE

MAJOR JOHN M. LOWERY

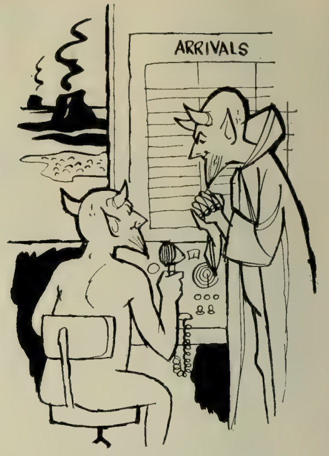
4 TACTICAL FIGHTER WING, SEYMOUR-JOHNSON AFB, N. C.

On 1 March 1965, Major Lowery was flying a Functional Check Flight in an F-105D. After 30 minutes of flight, a supersonic speed run was begun and at .95 Mach the aircraft appeared to have a slight longitudinal instability; however, this was believed to be caused by the external pylon fuel tanks. Above Mach one and at all subsequent speeds the aircraft responded normally. The FCF was completed and a turn was made for Seymour-Johnson AFB. While flying at 10,000 feet and 450 knots in level unaccelerated flight, the aircraft, suddenly and without warning, began to pitch and porpoise wildly. The stability augmentation was disconnected followed by the AC generator and battery switch. The porpoising continued with the aircraft now out of control. In a desperate attempt to save the aircraft, Major Lowery extended the speed brakes (battery now back on) and airspeed slowed to 200 knots. Although the porpoising continued, the aircraft was back under control. By experimenting, Major Lowery discovered that the pitch could be successfully controlled by using the stick grip override switch, but that the slightest back pressure induced on the stick caused the stabilizer to go full travel up and down. On returning to the vicinity of Seymour-Johnson, Major Lowery lowered the gear at 8000 feet. As the nose dropped, due to the CG change (caused by the gear), the aircraft again went out of control. Control was regained by again adjusting the pitch trim with the override switch. Flaps were lowered without difficulty. When over the runway threshold and starting the landing flare, the aircraft again pitched; however, control was maintained using power changes and trim override. The landing roll was completed without incident and the aircarft return to the flight line.

The porpoise was caused by a frozen lubricator bolt in the stabilizer actuator bellcrank and internal failure of the stabilizer actuator servo pistons. The dragging stabilizer actuator was immediately UR'ed. Major Lowery demonstrated outstanding airmanship and skill while handling a difficult flight control emergency. WELL DONE! ☆

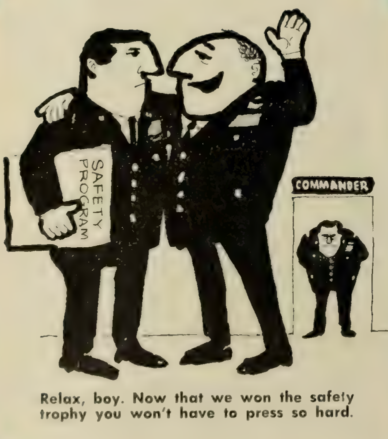


Whew! Rough party! But ol' Gallstone'll hack it. . . . ah . . . help me get some oxygen.

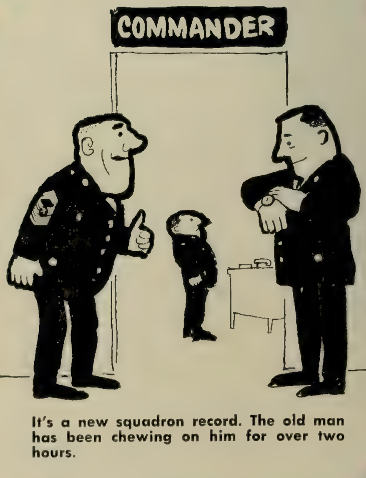


What is Gallstone's ETA?

TWO POINTS OF VIEW



Relax, boy. Now that we won the safety trophy you won't have to press so hard.



It's a new squadron record. The old man has been chewing on him for over two hours.

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FLYS

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UNITED STATES AIR FORCE

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VIETNAM AIRLIFT

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AEROSPACE
SAFETY

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FALLOUT

TAKEOFF

The closing line of "Takeoff" (Jan '66, pg 3) was a real eyebrow-raiser, coming as it did in an official USAF magazine.

One of the classic shortcomings of any house organ—government journals even more so than others—is their general parroting of the official line, with little, if any, disagreement of those On High.

Here's hoping that more sounds of dissent will be heard in AEROSPACE SAFETY in the future. It could make a first-class journal even better!

SMSgt Edward M. Parr
USAFR, 3 Donna Way
San Fernando, Calif

CIGARETTES

In the Rex Riley poster on the back cover of the February issue, is it necessary to depict two officers smoking cigarettes? What does this contribute to aerospace safety?

Show non-smokers, or pipe and cigar smokers. Are you with the U. S. Surgeon General or against him?

Albert Goldman (AVP)
Air Force Avionics Lab
Wright-Patterson AFB, Ohio

Rex is suffering withdrawal pangs.

SPINS

I was happy to see you reprint Don Engen's spin article in the February magazine. He certainly speaks from experience. I can't take exception to anything Don says but would like to make some comments concerning that champion of all spinners called the F-100F.

Don implies that if proper handbook procedures are followed, all of our fighters can be recovered from spins. F-100F pilots should be aware that if they do not recognize a spin and apply proper recovery controls quickly, the aircraft *most probably* will not recover. As stated in the handbook, recovery must be initiated before two turns are complete. It is *most* important to get the recovery controls in first and then to worry about jettisoning stores, etc. This can easily mean the difference between success and failure.

Naturally the pilot should be certain he is actually spinning before applying recovery controls. As an item of interest, the front seat pilot will likely find difficulty in holding full anti-spin control because of centrifugal loads and will probably have difficulty in getting into a good ejection posture.

During recovery attempts two hands are better than one and the rudder pedals should always be far enough out to allow full travel when needed the most. (Short fighter pilots, take notice.)

Most of what I have said is covered in the Handbook, but you would be amazed at the amount of misinformation concerning F-100F spins floating around this Air Force. Many pilots are under the impression that F-100Fs will not recover from spins. This is just not true and the test program bears this out.

The facts are that the aircraft in its present configuration with no strakes installed does not have the recovery characteristics desired

Continued on page 28

Mildred A. Norman, Directorate of Aerospace Safety

Do you remember that guy who used to come into the headquarters building several years ago? He was always checking on electrical outlets, percolators, extension cords, over-waxed floors, and even over-loaded filing cabinets. We had a nickname for him — "Safety Sam." We always thought he was some kind of a "kook," forever poking around into things he thought were unsafe.

Well, I've been thinking a lot about this safety business lately. It seems he wasn't the one who was out of step; we were! His job mushroomed as safety caught on and people all over the Air Force began to realize its implications. From just general safety, it became ground and flight, and then — with our ballistic missiles and complex weapon systems coming along — missile, nuclear and explosive safety.

Safety cannot be computed by any of our tables of measure. It isn't measured in terms of tons, pounds, feet — or bucketfuls. The dollar savings in materials will never make the cash register ring or show up in black ink on the ledger. Safety can only be measured by that warm glow you may experience from the knowledge that by doing your job properly, you have saved money, materials, lives, or most importantly, conserved a capability. No tangibles — just the satisfaction that, by correcting a potential hazard, you may have prevented a serious accident.

That accident you may have prevented could have been in your own home—the rickety kitchen stool you threw away possibly saved your wife's life or, at least, prevented a bad fall. That ground wire you put on the hedge trimmer may have saved your son from a lethal shock when he trimmed the ivy last week. Or, that warning note you put up may have prevented those workers being electrocuted by hitting the high-tension lines! The spill of oil you cleaned up, maybe that kept ol' Joe from taking a bad fall. Who knows? A bit of housekeeping may have kept the whole place from blowing up when later on you found that oxygen valve leaking! That checklist you followed so meticulously in making those wiring connections — suppose that prevented an inadvertent firing? Or, how about that paint job? That possibly saved thousands of dollars by retarding or preventing corrosion, and by sweeping up those flakes of chipped paint, you may have prevented a stopped-up drain. Then there was that time you cautioned that newly assigned young man to be sure to fasten his safety belt properly. If you hadn't, it's possible he could have fallen and broken his neck. Oh yes, how about the other day when you decided to make one last check on that elevator cage and you found it wasn't assembled properly. Gives me the creeps just to think about that thing crashing down on the silo floor! There's more, but I could come unglued at the seams just thinking about the things that might have happened.

So, looking back to that funny little guy who used to come into the headquarters building, he doesn't seem so funny any more. He seems to have gained stature and I don't think of him as a "kook." I'll bet he feels 10 feet tall when he sits back and recalls that in spite of the jeers he took in those days, people at last caught onto SAFETY. That "Safety Sam" is now politely referred to as the Safety Officer and takes his place on the righthand side of the Commander. ★

TWO MILES SHORT

When a T-39 crashed into a stand of trees on final approach, the subsequent story in the newspapers would have read something like this:

SIX SURVIVE CRASH

Six Air Force men miraculously escaped death today when their light jet transport crashed just two miles short of the runway.

The story probably would have dwelled on the fact that no one was seriously injured and included a brief discussion of the immediate cause. Since there were no fatalities and little civil property damage, the event was no longer news after the initial story and probably vanished from the pages of the newspapers forever.

Our discourse, however, must go beyond the immediate cause. We know that most of our aircraft accidents are preventable. Was that true of this one? Let's see.

The flight was a routine passenger haul with a T-39 IP in command of the aircraft. The only problems noted until penetration for the approach were that the TACAN did not respond to one enroute station and Control reported a weak IFF/SIF. This later was to prove a crucial factor. Briefed destination weather was forecast to be generally good, with 2500 feet overcast and seven miles visibility. While the aircraft was enroute, the destination forecast was revised to below minimums at times with snow showers during arrival period. The crew, however, was unaware of this change, since they did not request any weather reports while enroute.

The first indication of changing weather was received when the aircraft was over high station at destination. The crew was advised that their destination was closed for snow removal and asked to state their intention. The pilot replied that he had 45 minutes of fuel (1400 lbs) and that he wanted to land at home base. He then called the tower and was advised that the snow removal operation would soon be finished.

Meanwhile, the aircraft had entered a holding pattern and the pilot's next action was to call the command post, which gave him .2 miles visibility. The pilot returned to the tower and got an entirely different observation of 600 feet overcast and two miles visibility.

After holding at altitude for 14 minutes, the aircraft was cleared for approach. Two and one-half minutes later Control advised that the field was below minimums. The controller then added that the weather was expected to improve momentarily.

The aircraft was now at about 10,000 feet with 800 lbs of fuel remaining. The pilot said that he would continue the approach to ADF minimums and requested that he be kept informed of the visibility. GCA replied that the weather was still .3 mile and that they would keep the pilot informed. Two minutes later GCA reported the weather was .4 mile with snow showers over the approach zone and said the Ops officer wanted the fuel status. The reply was, "Forty minutes."

The pilot decided now that the visibility wouldn't improve enough by the time he was ready to land, so he broke off the approach at 3000 feet and asked for a vector to his alternate. Then, for the first time he became concerned about fuel. He reported 20 minutes remaining, which he immediately corrected to 30 minutes, and asked for a radar vector to a second alternate that was closer than his original alternate. At this point he reported that they were coming up on minimum fuel.

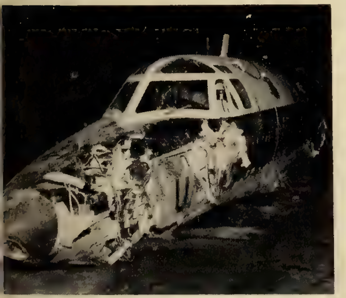
Control cleared the aircraft to the radio beacon at the alternate and informed the pilot that they were unable to get a radar return. Although both the ADF and TACAN were tuned to the station, the crew refused the clearance direct to the beacon and continued to request radar vector. Control, meanwhile, had misinterpreted the pilot's position report and confused the aircraft with another target. This required identification turns which consumed time and fuel. After contact was made, radar corrected the aircraft heading to intercept the final approach at the normal intercept point. Since the crew had not declared an emergency or even minimum fuel, they did not receive the most expeditious handling by radar.

Enroute to the alternate, the pilot maintained a low indicated airspeed rather than max range speed. This, with strong headwinds and turbulence, combined to reduce ground speed.

Although they had not declared an emergency, the crew now became so concerned about their fuel state that they shut down one engine in an effort to conserve fuel, which further reduced IAS and ground speed.

The approach was continued with normal GCA handling until the aircraft was about three miles out on final where the engine flamed out. Despite attempted airstarts, the crew could not get the engines running and the aircraft crashed two and one-half miles short of the runway.

Aircraft sliced through trees, shedding wings, engines and part of tail, but fuselage remained intact. Crew and passengers escaped with only minor injuries.



When the accident board finished, they had found the primary cause to be pilot factor in that the pilot did not use the proper indicated airspeed to obtain maximum range during a diversion. It would be hard to argue with this finding, but we think there are several significant factors that influenced this pilot's decisions and led to the accident.

In order of occurrence, these were:

- One of the enroute TACAN stations was NOTAM'd out, but the pilot did not catch this during preflight planning and believed that his radio was acting up when he failed to get the station. This possibly led him to not completely trust his equipment when he was cleared to the alternate base radio beacon after making the missed approach.

- When the pilot received conflicting weather from the command post and tower, he was inclined to go along with the tower observation because he had worked in the command post and knew that the weather available there did not necessarily reflect actual current conditions. Obviously, he was faced with a rapidly changing situation. GCA reported .3 then .4 of a mile visibility. But after the pilot had broken off the approach and headed for another base, the weather improved. The GCA controller, in fact, considered bringing the aircraft back to the original base but the weak IFF/SIF decided him against this action.

- The command post at no time exercised any authority and consequently never directed the pilot to take any specific action.

- The pilot did not make any fuel entries on the Form 21a. This was due to his familiarity with the route, which he had flown many times, and lulled him into a false sense of security as to his fuel state. Further, neither crewmember realized the effects of low altitude, low airspeed, wind and turbulence on the fuel consumption during the flight from the missed approach to the alternate. The Board had three recommendations in regard to this point: (1) airspeeds versus range and fuel consumption be reviewed in ground schools and included in annual aircrew proficiency exams, (2) a Diversionary Range Summary table be published, (3) the present T-39 checklist cruise chart be expanded to include data from sea level to 20,000 feet.

- The pilots apparently had a misconception of the term "minimum fuel," expecting that when they declared this condition they would receive emergency handling. But there was a reluctance to even declare minimum fuel. In fact, the closest they came to hinting that they might be in trouble was when they started "coming up on minimum fuel" just after making the missed approach, some 20 minutes before the accident. Consequently, they received no special radar handling. For those pilots not sure of what minimum fuel means, the following is quoted from AFR 60-16:

"Minimum fuel describes a flight condition in which all of the remaining usable fuel supply is necessary to assure a safe landing in normal sequence with other traffic. This condition does not warrant priority traffic handling; instead it will be used as an advisory to the traffic controller that any unusual delay will result in an emergency."

The definition of the term minimum fuel was changed on 31 December 1964. Both pilots and air traffic controllers should understand this term and the meaning should be the same to both.

Editor's Note: The Directorate of Aerospace Safety is proposing another change to AFR 60-16. Minimum fuel will be defined as sufficient to reach the runway and complete one go-around. The pilot will have more fuel available at minimum fuel but there will still be no priority in traffic handling. The pilot is still responsible for declaring an emergency when he feels that he has reached a fuel situation where he requires priority in landing. ★

FASTEN THAT TOP BUTTON

After graduating from single engine advanced flying school back in the brown shoe days, I was assigned to a fighter squadron and have been flying fighters ever since. Upon reporting to the fighter squadron, I was indoctrinated in the concept of fighter pilot thinking. That is: all pilots not flying fighters are bums and shouldn't even be allowed in the same sky with us—the cream of the crop. Even our dress was different: Leave the top button of your blouse unbuttoned and other pilots will recognize you as the rock that you are. Well, I endured numerous reprimands from commanders concerning the top button until a few months ago when I was forced to convert.

The word was out that our base would eventually lose all its jets. This had been declared before and nothing came of it, so I figured, "no sweat," I'll be gone from here before they shove a recip under me. Then one fatal day I saw a note standing out on my usually clean desktop. It read, "You are hereby relieved of duty as a T-33 pilot and will proceed to base ops on such and such a date to attend T-29 ground school." I raced around ranting and raving to all my boondoggle buddies only to find that they had received the same "greetings." No amount of pleading seemed to help because of the simple fact that there were no more T-33s.

The next step was T-29 ground school. That was a laugh. Not that the instructors weren't competent, but that we were so stupid. It suddenly dawned on me that I had been flying along fat, dumb and happy all these years with nothing more to do than kick the tires, light the fires and zap off. I also learned that all these years the multi boys had been happy that we were leaving the top button open. They didn't want to be associated with such a dumb lot.

Any ideas I had been harboring concerning the simplicity of recips were quickly eliminated. I was introduced to the hydraulic system, the electrical system, and the oil system. They are all complicated and all have at least three emergency procedures for each component failure. I previously thought that the flight mechanic had to know all the procedures, limitations and capabilities and all I had to do was fly the aircraft. I was right about the flight mechanic but wrong about the pilot. The flight mechanic is there to assist the pilot but he is not to make decisions concerning the safety of the aircraft.

Making a recip driver out of me looked like a hopeless case, but only from my viewpoint. The instructors nowadays are a new breed of people apart from my cronies of yesteryear. They give a student pilot credit for knowing absolutely nothing and start from there. They correct stupid mistakes, like feathering Nr 2 when Nr 1 has failed. They do these things without backhanding the student or blowing their tops. In the old days the instructors had to have two horns, two tusks and a loud voice. I finally realized that they were getting things across to me in their calm manner and I also began to realize why I had such a hard time teaching my daughter how to drive. The days of shouting and ridiculing are over. The younger breed has brought reasoning into the program. Of course there were some instances in my training where a well-laced shout was necessary, but only to save life and limb.

Day after day these flights went on, with me answering maybe 50 per cent of the questions, making half a dozen repeat mistakes, making a dozen new mistakes, and telling the instructor that I would dig more into the Dash One. Actually there's nothing duller than reading a Dash One on a strange airplane. It's like a doctor reading Hudson's Engineering Manual. But the boys kept plugging at me because they knew that eventually (twice as long as the ordinary young recip student) I would learn through repetition. Things were actually repeated twice because on the training flights two student pilots are scheduled. Each one flies for two hours and the other can watch his fellow student's mistakes. Luckily I was paired with one no more endowed with aptitude than myself. I learned from his mistakes as well as my own. This system also gave some added incentive because I thought, if this guy can fly the aircraft, I know I can. I'm sure he harbored the same thoughts about me. We got along fine with each trying to outdo the other, and I strongly suspect that this was the IP's *modus operandi* all along.

The training program consisted of many strange little goodies. Take the brakes: I thought the F-100 brakes were sensitive, but these are more so and more critical, for this sensitivity at low speeds. That's when you're taxiing and you don't want to jounce the Colonel passenger around. This brings up another point — passengers.

I had never bothered with them before. Now you have to wet nurse at least 20 passengers on each flight. Of the 20 there will be at least two high ranking officers who persist in being late for takeoff, or one is late and one is early. Then your only problem is to find out which outranks the other. So diplomacy and protocol are part of the training program.

Straight and level flying has always been a sore spot to me, for I thought of all the time the auto pilot was logging while the pilot made only takeoffs and landings. This conception changed when I found out that many auto pilots don't work, plus the fact that flights are made through or around the thunderstorms that I used to fly over. Radar? No such animal; you just have to buddy-buddy the centers for vectors.

I had thought before that landings were simpler because of the low landing speeds. I didn't stop to think that these low landing speeds make you vulnerable for short runways—all runways are not 10,000 feet long. The landing speed is not that slow anyway. A ballpark final approach is 120 knots and on a 3500-foot runway reverse should be used. This in itself is not simple. Both props in reverse are never synchronized so throttle steering must be used in the reverse range. Nose wheel steering can be used if you don't mind grinding off both nose wheel tires at this high speed. The landing itself is critical, for you can never make a landing so smooth that the passengers in the back don't think that they could have done better.

If you think there must be something better about this aircraft, you're right. Sometimes pilots do get sick. Here you simply walk to the back and toss your cookies like a gentleman.

Also, occasionally there will be a pretty WAF on board who thinks the pilot of this particular a/c is the most. Of course you're busy flying and the Colonel in the rear soon convinces her that you really are a bum.

Anyway, we (my fellow student and I) finally finished our training and were ready for the final test flight. This was to be the most comprehensive check ride I had ever taken. I remembered the instrument checks that I had taken in jets. I was always briefed before I took off on the approach to be used so that very little brainwork would be required while I was airborne. Not so in this bird. I was handed a SID immediately before takeoff, given revisions while climbing out, required to answer all sorts of questions about the aircraft as to what powers which instruments? And I was given the normal emergencies such as single engine, electrical failure, hydraulic failure, fire warning lights, low pressure lights and warning horns.

The IP tuned in one station on the bird dog and gave me a letdown for some station thousands of miles away. He said, "Look at this for one minute while I've got the aircraft." After one minute he said, "You've got the airplane, you're cleared to Podunk AFB, cleared for an approach." About then the station starts the swing and you make decisions fast. You ask at minimums if he has the field in sight and he never does so you execute a missed approach. When you reach the missed approach fix, he says, "Look at this for one minute." You go through the same thing again and repeat for TACAN, GCA, and ILS. Of course all the time he is simulating emergencies, so much so that I don't believe I completed any approach on two engines.

Just when I thought we had the last one knocked, he went to partial panel and I completed a gyro out approach on needle, ball, and airspeed. This entire check required three hours and three gallons of perspiration. I had never worked so hard before and felt good that I was able to complete the check. I am proud to say that I keep my top button fastened and don't want to be associated with the hot rocks.

I keep company with a different crowd now and I am regularly surprised at the intelligence these people have acquired in the last 22 years. No more kick the tires, light the fires and zap off for me. ★

SILENCE IS GOLDEN??

Maj James H. Broussard
Directorate of Aerospace Safety

A fighter formation returning from a gunnery mission entered the traffic pattern for a final landing. The leader pitched, lowered the gear and flaps on down wind, made a routine call on the base leg and landed. The wingman delayed his pitchout as briefed, but when he lowered the gear handle on the downwind leg, he noted the following:

- no red light in the gear handle
- no unsafe gear buzzer sound
- no green lights for the three gear
- no "feel" of the gear lowering.

In short, no lights of any kind glowed from the landing gear system. But on base leg he reported, "Gear down and checked."

On final approach, with the gear handle in the DOWN position he executed a go-around without stating any reasons and requested a closed pattern. As he flew past his leader he called, "Check my gear," and got the reply: "Looks OK from here." To the wingman this meant that the gear was down – actually he was clean as a whistle.

The pilot completed his closed pattern and was on the downwind leg for the second time when some "goodies" began to display themselves in the cockpit – in contrast to those in the gear system that failed to appear. A few of the more important indications are listed:

- Fuel low level warning light blinking
- Fuel quantity gage stuck at below 2000 lbs.

As added insurance, the pilot pulled the emergency gear extension handle while on the downwind leg; on base leg he reported, "Gear down but I get no gear indications in the cockpit."

Upon hearing this statement, Mobile Control got quite concerned over the issue, took a good look at the aircraft and told the pilot, now on final approach, that he had no gear.

SURPRISE! SURPRISE! SURPRISE! not only to the pilot but to everybody who had been listening to the radio transmissions.

Let's stop here, review the proceedings and recapitulate for a moment.

From hindsight, it's easy to criticize a pilot's action or inaction, but basic practices which have been instilled in us from the very beginning of our flying days and generally accepted by professional flyers as canon law, were ignored. One might ask, "Was it really necessary for the pilot to relate his cockpit observations, action taken and general feeling about the situation when he first noticed them?" We say yes.

When the pilot was positioned on the downwind leg, was it really necessary for him to relate his original cockpit indication, plus low fuel state and the fact that he had pulled the emergency gear extension handle? Again, we say yes.

Now let us continue with our story and see how the lack of vital information from the pilot compounded this problem and forced him into a situation that nearly cost him his life.

When the pilot was told by Mobile Control that he had no gear down, he acknowledged and initiated a go-around. Because of the unknown fuel status, he decided to get away from the populated area, gain altitude and make bailout preparations. He orbited about 10 minutes, requesting aircraft to observe his gear status. About the time he was sighted by the pilot of another aircraft, he pulled the manual gear extension handle for the second time and was told that his gear was down. He elected to return to the base but the engine flamed out approximately ¾ mile from the runway. He continued to maintain control and the aircraft impacted on fairly level terrain approximately 900 feet short of the overrun. The pilot survived the crash and walked away from the wreckage.

In summary, it is fair to say that a little talking might have prevented this accident. ★

Communication: Some say it is the art of getting the other fellow to see your point of view. Regardless of how one defines it, communication is an essential part of accident prevention.

HOW DO YOU HEAR ME?

Bob Harrison

One of the remarkable attributes of human beings that separates them from lower forms of life is their extraordinary ability to communicate. Other forms — even insects — apparently do communicate with each other, but their capabilities are limited to functional transmissions, whereas we humans operate across a much broader spectrum up to and including the communication of abstractions. Yet, paradoxically, one of our greatest shortcomings is lack of communication. How do we account for this paradox and what are its implications? Before we try to account for it, it might be best to discuss some of the results of our lack of, or imperfect, communication.

The consequences of not communicating depend on the situation and range from perhaps minor annoyance to disaster. A person would be annoyed, but there would be no hazard involved, if he ordered a white car with red upholstery and, instead, got a red car with white upholstery. Misunderstandings of this degree occur every day and about the only thing that flares is tempers. But what about the driver who signals a right turn then turns left? This can cause all kinds of havoc, even a catastrophe, if the driver behind acts on the signal he perceives and attempts to pass on the left. Chances are, he is wary of any such signal and waits until the other driver has made his move.

Pilots, too, have communications problems, some minor, others that

One of the most serious problems is communications between people. Having been conditioned

are of more serious import. A mistake on the part of a wing walker—or the pilot's misinterpretation of his signal — might result in a dinged wingtip. But a misunderstanding of assigned altitude could culminate in a midair collision.

But there are more than mechanical breakdowns in our communications processes. Interpretation plays a big role, perhaps even a greater role than the mechanical aspects. We humans are the product of all of our experiences — experiences which shape and mold the way we behave and the way we look at things. Just as an object may appear different to two observers standing at different places in relation to the object, so do we tend to see things differently due to psychological variances. Supersonic flight, for instance, may seem extremely hazardous to the uninitiated, but to the pilot who does it every day it is routine and holds no terrors.

The man who must give a speech for the first time may be terrified. But after several exposures he usually adjusts to this frightening experience and has no qualms at all. Some of us may, for some reason, never become comfortable before an audience, or at ease flying a high performance jet.

How we perceive things and situations depends to a great extent upon past experience, or lack thereof. If experience indicates that a particular course of action could be hazardous, embarrassing, or just uncomfortable, then we are reluctant to get ourselves involved. If we have never been there before, so to speak, then we may react in a number of ways. We may relate the situation to a different kind of experience but one that is painful, in which case we will try to avoid involvement. Of course, the opposite is true when we draw a parallel with a pleasant experience.

To the experienced pilot, who is also current, weather within certain limits has no terrors. But to the student pilot, the idea of penetrating and landing when the weather is near minimums may be extremely frightening, possibly to the point where he will refuse to make the attempt, even though he has the assurance of training and practice in a simulator that he can make a successful landing.

One of our most serious problems is communications between people. Having been conditioned to look at things from a certain point of view, we often refuse to accept another's point of view. The controversy now going on in this country over the Vietnam war is an example.

To a pilot, communications with air traffic controllers is vital, yet there are often differences of opinion and misinterpretations. Some of these result from mechanical problems in transmission of messages. Until our electronic communication equipment becomes perfect, this will continue with, occasionally, drastic results. But more difficult to overcome, perhaps, are the interpretations of communications between pilots and controllers by one or both parties. Here's an example. As you will see, there are two sides and I'm sure it would be very difficult to convince either side that the other is 100 per cent right.

At 1800Z the pilot taxied his aircraft to the runway, received the clearance he had filed two hours earlier and was instructed to hold clear of the active. His description of the next few minutes is as follows:

"At 1805Z I called the tower and requested the reason for the delay. The tower operator informed me we were being held due to inbound IFR traffic. At this time, there were approximately two C-141's, and one each C-124, T-39 and T-29 in the traffic pattern shooting touch and go's and practice GCA's. At approximately 1810Z, two F-84F's completed a VFR practice GCA with a low approach and a go-around to re-enter the GCA pattern. I then went to the departure control frequency and asked why we were being held. Departure control stated that we were being held for two inbound F-84F's and the controller also stated, in accordance with a letter of agreement, no IFR traffic could depart if any inbound conventional IFR traffic were within four miles of the base or any IFR jet traffic were within six miles of the base. I informed him that the two F-84's had already completed one practice GCA and had re-entered the GCA pattern. He reiterated we were being held for inbound IFR traffic.

"We returned to the tower frequency, contacted the tower operator and asked if we were being held for these two F-84's, but the tower controller would only admit that we were being held for inbound IFR traffic. At 1820Z the two F-84's completed another practice VFR GCA, initiated a go-around and again entered the GCA pattern. At 1825Z, after more conversation with the tower operator, we were cleared into position for takeoff. Total time spent on the ground awaiting departure was 25 minutes.

at things from a certain point of view, we often refuse to accept another's point . . .

"The cited situation and procedures are inconsistent with efficient and intelligent traffic control concepts. A procedure which allows one inbound IFR aircraft to hold up departure aircraft does not fully utilize the capabilities or the flexibility of modern radar control techniques and equipment. One efficient controller should be able to direct seven aircraft simultaneously or he should not be a controller."

Now this sounds pretty bad. I'm sure that this pilot has a lot of sympathy and many of his brethren are undoubtedly saying amen! But let's flip the old coin and take a look at the other side. Here was the reply:

"The tower tape has been reviewed and the following facts have been revealed. From the time of the first contact with the tower, when the pilot requested taxi and takeoff instructions, until the aircraft was in the vicinity of the runup pad for runway 35, the lapsed time was six minutes. At this time, the aircraft was number three for departure. From this time there was an actual 12 minutes delay due to conflicting traffic. The traffic consisted of numerous arriving IFR aircraft and departing aircraft that were ahead of this aircraft which was being held awaiting ATC release.

"After the 12 minutes delay, the pilot elected to leave ground control frequency to attempt contact with the center. This was unsuccessful, so contact was made with departure control. The aircraft was standing by on Guard frequency. At this time, the tower received an ATC release on the aircraft. Attempt was made to contact him on the ground control frequency with no response. Contact was not made on Guard as the release of this aircraft is not considered an emergency. He was off ground control frequency for approximately three minutes. During this time, the ATC release was canceled due to conflicting traffic. The pilot came back to ground control frequency and made several unnecessary radio transmissions concerning why he was being held. Another ATC release was received by the tower in approximately two minutes and the aircraft departed.

"From the time the aircraft taxied to the runup area, and reported that he was number three for departure, until takeoff, the elapsed time was approximately 17 minutes. Three minutes of this delay was self-imposed when the pilot elected to take it upon himself to determine the delay by contacting FAA. An additional delay was encountered of two minutes when the ATC release was canceled as the tower could not contact the aircraft while he was talking with the center. The aircraft could have been released approximately four minutes sooner which would have made the actual delay approximately 13 minutes. The six minutes required to taxi from the ramp to the runway end cannot be construed as a delay."

Now I submit that there are two sides to this story and that, depending upon one's job—pilot or controller—the reaction is going to be to go along with one side or the other. How many of us are willing to accept, at first blush, the possibility that neither side is wholly right nor completely wrong. Have you ever met a truly objective man?

One of the fascinating things about people is that most of us really expect other people to see things in the same way that we see them. True, people from similar ethnic, social and economic backgrounds will usually tend to agree upon certain things. Meanwhile, they may be disagreeing violently in other respects. Who knows? The pilot and the controller whose stories we related above may have been born and reared next door to each other back in Whippoorwill Falls, attended school together and roomed together in college. But when they eventually went their diverse ways, well they certainly have some differences. On the other hand, would you like to bet how two such individuals might feel about social and religious matters?

This discourse is not without purpose. Perhaps it is a sneaky way to get around to safety, but the impact of our imperfect communications on safety is tremendous. Obviously safety is dependent upon good communications; therefore, as we improve our ability to communicate, so will we improve our accident record. Education, I believe, is the key, on the one hand, and, of course, the advance of technology that enhances our mechanical ability to communicate, on the other.

I doubt if we will ever completly lick this problem of communications but certainly there will be some improvements. Some needed improvements that have occurred to me, in the area of flight safety, are:

- Similar interpretation of such terms as turbulence, emergency, Roger, guard channel. If we can't get common understanding of these and many other terms, then we ought to try to either eliminate them or at least make them more specific in definition.
- Better understanding of other people's jobs and requirements. For example, Ops versus Maintenance, Traffic Control versus Operations, safety versus getting the job done, R&D versus the user, weapons designers and users, weatherman and pilot, passenger and pilot, commanders and subordinates.

You can undoubtedly add pages to this list. The point is that, as differences are eased and understanding between different activities becomes clearer through better communications, the accident rate can go only one way — down. ★

Rex Riley
CROSS COUNTRY NOTES

WHEN THE DRAG chute didn't jettison and the F-102 taxied over it, the events that followed led to a 96-manhour repair job. The chute got tangled up with the left brake and finally tightened enough to break the air line to the brake. Eventually the aircraft ran into a building.

As a result of this mishap, unit procedures have been revised and a change to the Dash One recommended, as follows: "The drag chute should be jettisoned before taxiing downwind in winds exceeding 15 knots, due to the possibility of the drag chute collapsing and becoming entangled in the wheel area which may cause brake failure."

ALL OF US MAKE mistakes, and the person who says he doesn't is either a liar or a fool. Most of us, however, try to correct our mistakes. When a mistake can't be corrected by an individual, and there is a hazard involved, is no time to clam up and let the chips fall where they may — but this occasionally happens.

After the loss of an F-100, investigators found that the Nr 4 engine bearing failed due to oil starvation. It is thought that an oil sampling bottle that had been dropped in the reservoir blocked the oil supply line.

It is not inconceivable that such bottles could and have been dropped into reservoirs. It is hard to believe that anyone would let such a situation go uncorrected and unreported, but apparently that was the case.

There is one person who knows who dropped the bottle and that it was not recovered. Rex hopes he is reading this because it is possible that he does not know of the loss of this aircraft. Perhaps knowledge of what occurred will prevent a like situation in the future. As for those to whom it hasn't happened yet, it could — as we said, it is human to make mistakes. But it is inhuman not to correct them or, at least, report them so that action can be taken before someone else's life is jeopardized.

PEOPLE, ESPECIALLY children, swallow all manner of things and survive. Jet engines are not so hardy. Take the F-102 that gulped down an external tank safety pin the other day; the engine had to be overhauled. Seems that a maintenance technician removed the pin and started up the ladder to hand it to the pilot. He didn't have a good grip on the pin, the streamer fluttered and away went the pin into the engine intake.

This sort of thing happens frequently enough to be serious. Rex would hate to have to pay for all the engines thus ruined, but when he pays his taxes a bit of the bundle goes toward financing this sort of foolishness. What say we all be more careful? Wrap the streamer around the pin, then hold it tightly; be careful of hats, objects in pockets and people to be sure they don't get sucked into jet engines. Rex can't afford it and neither can you.

CAPT ROBERT H. MORGAN, a member of The Thunderbirds, had an encounter with another kind of bird and the manner in which he handled the ensuing emergency won him TAC's *Pilot of Distinction* for February.

During a Thunderbird demonstration at Waukegan, Ill., Captain Morgan, a solo pilot, was flying in a two-ship formation. Approximately 50 feet above the water of Lake Michigan and at a speed of more than 425 knots, his aircraft struck a sea gull. The accident happened at the start of a roll, and caused a hole in the left side of the cockpit and a loss of pressurization.

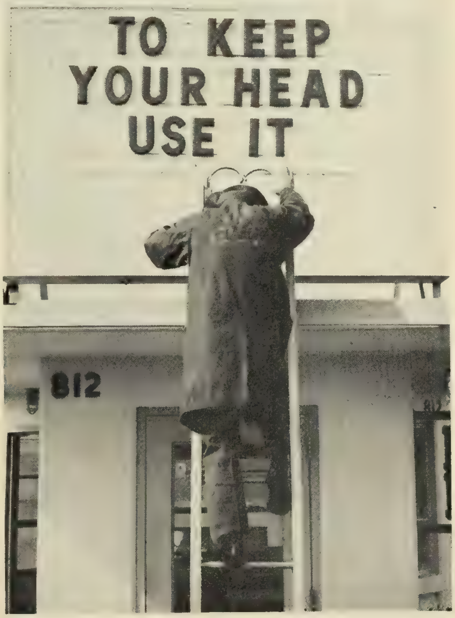
Before the roll was completed, a second bird struck the aircraft shattering the canopy. The bird continued into the cockpit, striking Captain Morgan on the head. His left hand was knocked off the throttle and pierced by splinters from the canopy.

With the cockpit littered with broken fragments and the remainder of the bird, Captain Morgan, although unsure of aircraft condition, landed his F-100 successfully.

PERSONNEL ERROR (BUZZARD) — Among the many, many mishap reports that arrive daily there occasionally is one that lightens the monotony and cheers one's spirit. Such is the following message, reproduced here with only minor editing.

"Immediately after takeoff, before retracting gear, aircrew observed a large airborne bird on collision course with aircraft. Bird apparently recognized impending disaster, and initiated violent evasive action, consisting of folding wings, and entered near vertical dive. Aircrew observed bird pass under aircraft nose and heard thump from somewhere on underside of aircraft. Post-flight inspection of aircraft showed no damage or indication of where bird had impacted.

"Inspection of runway revealed carcass of large buzzard-like bird of approximately 40-inch wingspan. Suspect that bird struck landing gear tire. Primary cause of incident is personnel error (buzzard) in that he attempted to fly through airport traffic area without proper air traffic clearance . . ."



HEADS UP — A3C Paul Gardner didn't really lose his head. Another airman who used his head was A2C John Offutt, who snapped this picture at just the right time. It happened at Hamilton AFB while Airman Gardner was installing sign over main gate. ★

FLYING SUPERVISION

CUSS.....CUSS.....
ETC....

Maj Joseph L. Ashbrook, 3625 Tech Training Sq (SC) (ATC), Tyndall AFB, Fla. 32401

The weathervision indicated the ceiling was 700 broken, several intermediate layers, tops 20,000 feet with surface visibility four miles in light rain. Having just arrived at operations from outside, I accepted the latest weather sequence except for the rain. Outside it was pouring and there was a 10-15-knot wind which caused the rain to fall mostly in a horizontal rather than vertical plane.

The thoughts racing through my mind were the same as those that had occurred several hundred times during 22 years of military flying: The weather sure isn't too bad to fly in, but how I hate to preflight in the rain and have to fly a mission dripping wet!

In combat during World War II, Korea, the Formosa skirmish and currently Vietnam, operational missions in heavy downpours are a necessity; however, is there a real need for conducting training missions where both aircrews and ground crews are drenched, ground equipment is thoroughly wet, personal equipment is soaking wet, ground preflights are performed too quickly and ground operations (taxi, moving ground power equipment, parking, etc.) are all jeopardized? Finally, *where is the Flying Supervision?*

The USAF has long advocated the concept that flying operations start with mission planning in the operations building. They don't end until the mission has been concluded, you return to operations, and all mission critique and debriefing forms are completed. I, for one, am a disciple of this concept and have followed, supported, participated in and directed adherence to it for many, many years. This day, I wondered where all the other disciples might be, as I watched ground and aircrews do a very unprofessional job in preparing F-101, F-106 and T-33 aircraft for training missions in a driving rain.

Accepting the frailties of man, I suited-up, filled out my clearance and proceeded to PE for my flight gear. By the time I had run the 150 yards to PE I was quite wet (my orange flight suit was the shade of a dull red brick). Bus transportation was available from PE to the aircraft, so my equipment was protected. But on the flight line, there was no cover, the ramp was a mass of puddles, all the ground crew were completely drenched (even with water repellant clothing) and all aircraft were buttoned up against the blowing downpour. My personal poncho (PE had none) was blowing such that my chute, LPU and safety accessories became as drenched as they would be during sea survival.

Surveying the ramp, the ground crew that were drenched, the aircrew scurrying around their aircraft performing hurried, partial preflights, I proceeded to the Wing Operations Command Post to ascertain whether they were aware of the situation and if they were evaluating or taking any action to eliminate the potential hazards caused by the heavy downpour.

As is usually the case, the command personnel disclaimed any responsibility for postponing flying operations until the rain subsided; in fact, their attitude was one of complete professional apathy. *"Flying Supervision, where are you?"*

The remainder of this story is anti-climactic. I started on my scheduled target mission with full chaff tanks; almost taxied into an F-101 pulling out of his parking spot (rain was so heavy on the T-Bird windscreen); took off through puddles so large they completely engulfed the T-Bird. Due to nose gear trouble (cocked or partially retracted I couldn't ascertain because of the weather) I aborted the mission 10 minutes after takeoff. I flew a highly erratic GCA approach due to yawing of the aircraft (ball of needle-ball deflected one full ball-width to left) and full chaff tanks that wouldn't permit reducing speed to below 170 kts indicated. The nose gear was finally locked in the down position with the emergency system and I landed on a 12,000-foot runway, using 11,500 feet, and avoiding the "rabbit catcher" only by opening the aircraft canopy.

NOTE: Touchdown was 1000-1500 feet from the approach end of the runway at approximately 125-130 kts. Brakes became effective at the point where runway markers showed 4000 feet remaining.

Landing gear pins were installed on the runway and I returned to the ramp and shut down. At operations I completed my mission card, debriefed base weather (landing weather was 400 broken to overcast, one mile in moderate rain showers, haze and papermill smoke) and proceeded home.

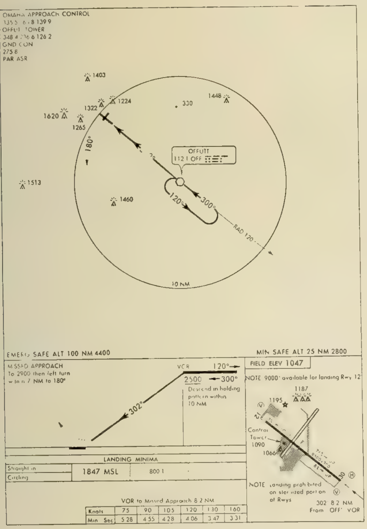
The incidents described occurred on Saturday. On Monday I had a runny nose, slightly sore throat and some intestinal problems. All my PE equipment had to be opened, dried and re-packed.

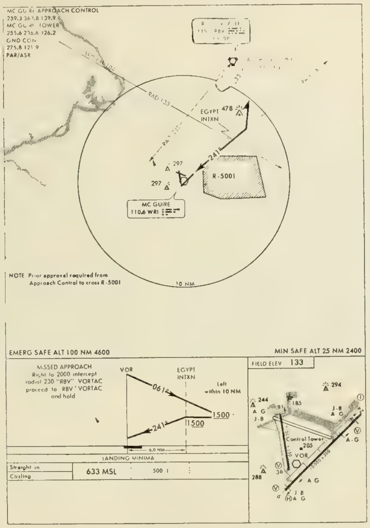
I do not feel any personal animosity toward any individual, unit or organization, I only question the professional need for placing flying operations, other than those of a combat or emergency nature, in such jeopardy because of human frailties.

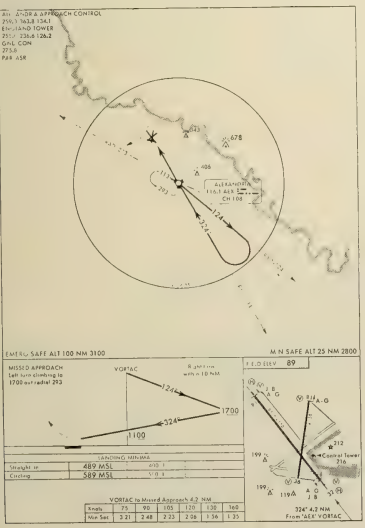
To all who read this article, I hope the next time you are AO, Supervisor of Flying or the Duty Officer in a command post, and you look out into a sea of blowing rain, plus wet ground and flying crews, the thought of, *"Flying Supervision, Where are you?,"* may penetrate your warm and dry working area as a message from that same wet, windy ramp! ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas







Q. These three types of procedure turn depictions are being used in FLIP Terminal Instrument Approach Procedure Charts. What are the procedures for flying each?

A. Procedures for flying the procedure turn are contained in AFM 51-37 and are the same for all three depictions. Also, unless otherwise noted on the approach chart, obstruction clearance area provided is the same for all three depictions. The IPIS is evaluating the different depictions in an effort to arrive at a single DOD standard. Which type portrayal do you prefer? ★

VIETNAM A

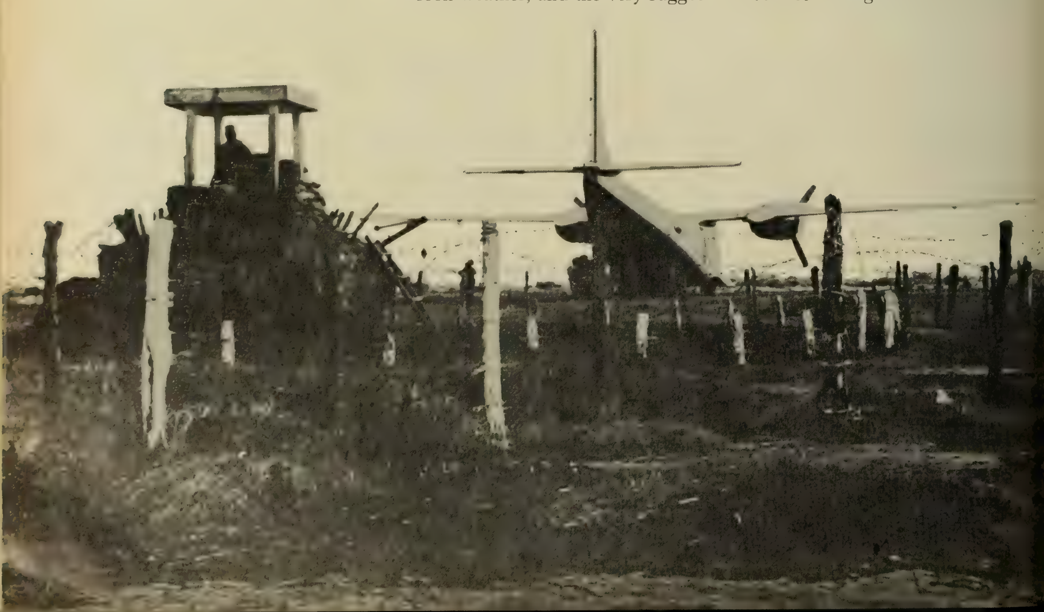
A lot of crews who haven't had the experience of flying in a combat zone may get that experience someday in Vietnam. Here's what it's like for cargo pilots.

Counterinsurgency operations in Vietnam are largely dependent on airlift for supply. Transportation on the surface is at best difficult and frequently hazardous. Roads and railroads are scarce and are vulnerable to damage, interdiction and ambush, by the Viet Cong, besides being frequently damaged by heavy rains and floods. Airlift must, therefore, assume much of the burden for the movement of men and supplies into and within the country. In the case of remote and isolated outposts, such as Special Forces camps near the Laotian border, airlift may be the only source of supply, and these supplies must be delivered (directly) to the front door of the user.

Even under the best of conditions, aerial supply in a combat zone is challenging. This is a particularly difficult mission in the northern provinces of South Vietnam because of the strategic situation, the low ceilings and visibilities of the monsoon weather, and the very rugged terrain. These northern provinces are under the jurisdiction of the I Corps of the Army of Vietnam.

The 315th Air Commando Group's 311th Air Commando Squadron at Danang AB, Vietnam, supplies the lion's share of the airlift in this area with twin engine C-123 Providers.

A glance at the map reveals the strategic value of the area, and also indicates some of the reasons why the mission is a difficult one. The I Corps borders North Vietnam on the north and Laos on the west. A narrow coastal plain borders the eastern coast, which is a rich, densely populated rice growing area. To the west of this plain, the Annamite Mountains rise abruptly, with peaks approaching 10,000 feet. The average elevations of the higher ridge lines would run about 6500 feet, and the valleys are steep sided with very rough and rugged terrain. The dense jungle foliage on these mountains sometimes reaches 200 feet in height. This continuous



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ry G. Howton, 315 Air Div, PACAF

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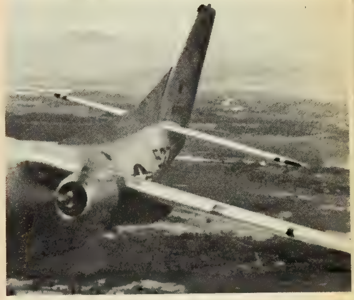

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VIETN

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RLIFT

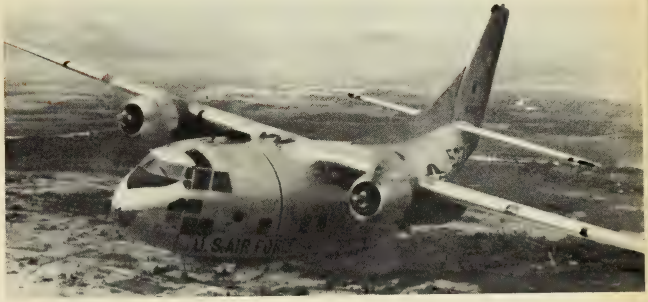
Col Harry G. Howton, 315 Air Div, PACAF

canopy could easily swallow an aircraft and re-form over the wreckage to completely obscure all evidence of the crash.

Nevertheless, this is a vital area which is significant not only for the security of the rice-rich coastal plain, but also for the Ho Chi Minh Trail, which parallels its western slopes on its way to the south. The outposts in these mountains are generally small and manned by Vietnamese Special Forces troops, Nungs, Montagards, or US Army Special Forces advisors.

At some of these stations, an assault landing strip has been prepared, but at others it has been possible to hack out only a small "postage stamp" sized Drop Zone. There are no NAVAIDS at these Landing Zones (LZs) and Drop Zones (DZs), and they must be located visually. During the summer, when the weather is generally good in the mountains, these fields can be found easily enough, but the tricky mountain winds, the short, narrow fields with improvised surfaces, and the terrain obstructions in the approach zones requires very high pilot proficiency. During the winter, when the northeasterly monsoon brings low ceilings, rains, and low visibility to the entire area, the mission of supplying mountain outposts is as tough a flying assignment as can be found anywhere in the world, but supplies must flow 12 months a year.

When the weather is bad in the mountains (there is no reliable weather reporting) the first attempt to locate a mountain LZ or DZ is normally the "on top" approach. The aircraft attempts to climb over the overcast, perhaps to 7000-9000 feet. If the clouds cannot be topped at this altitude, it is sometimes possible to circumnavigate buildups and fly between layers to thread one's way to the target.



C-123's flown by 315 Air Commando Group provide airlift to remote areas.

Since there are no weather minimums for tactical aircraft in Vietnam, crews use "common sense clear of clouds" and "safe visibility" as visual conditions. Visual flight may be made in conditions much lower than minimum standards back in the United States. Obviously, navigation under these circumstances is very difficult. Much navigation must be done by dead reckoning or by the limited visual contacts that can be made. Since there are no navigational aids, descent to the target LZ and DZ cannot be made blind, and visual conditions must exist that will allow the aircraft to make a maximum performance descent with low manifold pressure and low RPM, and with gear and full flaps down.

There is no room for error under these conditions, and all members of the crew must assist in visual identification of the position. It is extremely easy to become disoriented in a high rate descending turn with no references except clouds and green jungle slopes. Even crewmembers who ride in the cargo compartment learn enough of the terrain to be of assistance by looking out of the side windows or out the open tail gate. Prominent peaks,

Live cows are unloaded at Ashau, a remote Vietnamese outpost. Despite the stringent security this C-123 was hit several times by Viet Cong sniper fire.

C-123 crews are accustomed to strange cargoes. Bovine passengers, other livestock are carried routinely to remote sites.

VIETNAM AIRLIFT continued

when their tops protrude ominously through the clouds, occasionally may be useful landmarks for position identification.

If it is not possible to find the target over or around the clouds, the next attempt is to try to go under the clouds by flying the valleys. The aircraft may return to the coast and descend through the clouds over the south China Sea or the coastal plain. Sometimes, however, it is better to continue westward beyond the higher ridges to the better weather on the west side, and then double back by flying east from the good weather area.

Once under the clouds, the pilot will attempt to find the valley or valleys that lead to the target area. A 900- to 1000-foot ceiling on the coast with visibilities of two to three miles may be enough to allow the aircraft to use these canyon flying techniques.

Frequently it is necessary to zig zag back and forth along the base course to get into the destination. The valley walls are steep, however, and as soon as the aircraft enters the higher mountains from either direction, the valley walls extend up into the clouds above the aircraft on both sides. Obviously, this business of canyon flying requires a great deal of coordination among the entire crew. The aircraft should never enter a canyon or valley unless there is another way out, i.e., an alternative course of action in the event it is not advisable to continue straight ahead. Mechanical failure, deteriorating weather, and ground fire are all factors that may make it mandatory to look for alternatives.

Some of the canyons are wide enough to allow a 180-degree turn, but to get maximum performance in these turns it is sometimes necessary to use steep bank (60 degrees), maximum power, and flaps to reduce stall speed. If the aircraft is flown down one side of the canyon to permit more turning room, it may be exposed to ground fire since the VC like to concentrate in the valleys of known routes during the bad weather season to take shots at the low flying aircraft.

Map reading from large scale maps (1:250,000) is a critical skill that many pilots and navigators must re-learn, especially if their recent experience has been in high performance aircraft. Not only must the precise position of the aircraft be known at all times for navigational purposes, but it is also necessary for pin-pointing the location of ground fire, and for keeping abreast of terrain clearance information on the ridges in the clouds above both sides of the airplane. One pilot flies the aircraft, and the other pilot monitors the instruments, the map, and cross-checks the terrain. There is a previously agreed upon emergency climbout procedure at all times in the event it is necessary to enter the clouds, and only the most accurate map reading will determine a climb heading with adequate terrain clearance that will allow this to be done safely. Navigators, when available, are invaluable under these circumstances because they allow both pilots to pay more attention outside the cockpit.

Air drops are among the most difficult missions flown by the 311th for several reasons. The DZs most commonly used are very small, and require high precision drops. The squadron rarely uses free-fall techniques because troops and camp buildings crowd the DZs. Parachute techniques from very low altitudes are used to minimize wind drift. Air drop cargoes vary widely from food and ammunition to almost any thing an outpost might need, including lumber, ducks, cows, pigs and chickens. Bundle weights range from 200 to 1500 pounds.

Hiep Duc, one DZ, is on the side of a hill in a bowl shaped valley with higher terrain on all sides. Surface winds are gusty and unpredictable. Extreme precision is necessary on this drop. The pilot flys the pattern, and when turbulence is encountered, he handles the throttles. The co-pilot monitors the instruments and is prepared to take control of the aircraft instantaneously in the event the pilot is incapacitated by ground fire. The navigator gives the pilot vectors and controls the drop signals. The crowded terrain limits the size of the pattern and requires the loadmaster, the Special Forces paratrooper and the flight mechanic to rapidly prepare subsequent bundles for delivery after each pass.

Flying into Diep Duc with a gross weight of 52,000-53,000 pounds and low airspeed leaves limited reserve power emergency. Although the assault landing characteristics of the C-123 are very good, there are many times when it would be convenient to have more horsepower, especially when flying with heavy loads. An engine failure under these circumstances can create a very interesting situation, in which about the only thing that will save the aircraft will be jettisoning the cargo as rapidly as possible and finding a passage to lower terrain through the valleys.

Ground fire is common on air drops because the Special Forces camps are located in areas where the VC operate and because the aircraft must make repeated passes at low altitude. Constantly changing patterns help to reduce the problem of ground fire. Sometimes fighter cover by Vietnamese A-1Hs is available, but frequently the weather is too bad for fighters during a drop.

Defense techniques have had some success against ground fire. One procedure that has been successful at a DZ is mortar coordination with the Special Forces camp. When ground fire is encountered, a smoke grenade or flare is dropped by the C-123. The camp then lays mortar fire a few meters back along the track of the aircraft. Not only does the smoke pinpoint the ground fire for the mortars, but it also allows the pilot to avoid flying over the same area on subsequent patterns. Few VC snipers are eager enough to ask for a mortar attack on their position.

All landing zones have their peculiar challenges. At Khe Sangh, for example, the elevation is 1600 feet, the runway is 66 feet wide and only 3200 feet long. The surface is PSP (pierced steel plank) laid over laterite clay. When monsoon rains soak the field, the clay oozes up through the holes in the PSP and the surface gets so slick that there is no nosewheel control or braking action.

Since the normal winds at Khe Sangh are very gusty quartering tail winds on final approach, and since the touchdown end of the runway, with a 10-degree upslope, is only 200 feet away from an 800-foot gorge, it is clear that mountain flying is no child's play.

Or take Kham Duc. The final approach there is over a ridge which is perpendicular to the runway. The ridge was so high that the engineers had to cut a notch 50 meters deep for the final approach, but even with this assistance, it is still necessary to fly an exceptionally steep final.

ARVN soldiers wait to board transport for airlift to combat area.

Several passes are needed to drop the cargo, and ground crews hustle to retrieve the precious supplies before the enemy can snatch them away.

Or Gia Vuc. The field is a rolling, narrow former pasture that has the usual ruts and mud holes in it. If you miss it, just fly up the valley about five clicks (kilometers) until you get shot at and you'll know you missed, but be careful on that final approach or you will hit the water buffalo fence. If one of the engines fails to reverse you may be introduced to the actual performance of a mine field in full operation.

Although flying C-123s into the mountains is very demanding, it does provide opportunity for great aircrew satisfaction. It demands a maximum of judgment and discretion on the part of the aircraft commander. He must decide whether the urgency of the load for his target at this time justifies the degree of risk implied by the conditions he encounters. This is a situation which emphasizes the judgment of the man-on-the-spot who is the only one with sufficient information to make that decision. In this respect it stands in contrast to the recent tendency in some areas to centralize decision-making in the Command Posts. To meet this challenge aircrews must constantly strive for maximum proficiency in all aspects of the mission. Precision in procedures and techniques is the word-of-the-day.

The unique conditions in Vietnam and the urgency of the missions makes theater orientation a very important aspect of the crewmember's training. Even the best must first see exactly what the situation is before they are fully qualified. Still, there are few flying jobs anywhere in the Air Force that give the crewmember a higher sense of achievement or a stronger feeling after a successful mission of a good job, well done, with minimum compromise to safety. ★

THE MAN FROM NORTON

The man seated at the desk in the picture is a system project officer in the Directorate of Aerospace Safety. The letter he is writing might be addressed to almost any unit or organization that operates or is responsible for the control, maintenance or support of any USAF aircraft or other system (the term aircraft will be used in this article, but refers to other systems also). The subject line of the letter probably will begin, "Notification of Project Officer Visit to. . . ."

When one of these letters arrives, the result can be quite similar to our ancestors' reaction to Paul Revere's cry about the Redcoats coming, only now the cry is about that "durn IG's" coming. The impending visit will sometimes disrupt things around a base, since notification normally allows almost a month for hiding skeletons before the "inspection." The truth of the matter is that a Project Officer Visit is NOT an inspection, and it is NOT an "assistance" visit. Rather, it is an information and educational effort intended to help the visitor.

This type of visit is a necessary part of the activities of project officers from the Directorate's Flight Safety Division. In order to keep abreast of problems concerning the aircraft he monitors, it is necessary for him to travel through using and supporting organizations, and there aren't many of these in our local traffic pattern.

There are other types of scheduled visits such as Safety Surveys, Staff Assistance Visits or Safety Study Research Visits. These are more formal and generate a formal report. There are also some unscheduled visits in which the objective may be only a flight sortie in a tactical aircraft.

Let's look at the individual who carries the title of Project Officer and at the organization he represents. We will also discuss some of his more specific duties. He is usually a major or lieutenant colonel who has been selected from a tactical organization, or similar source, where he has qualified in one of the more important aircraft currently in use.

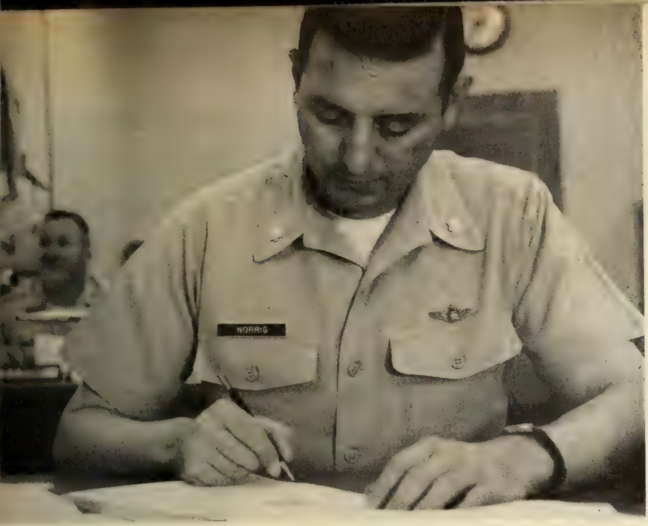
Norton AFB is the home of the Deputy Inspector General for Inspection and Safety, USAF, and its two subordinate directorates, Aerospace Safety and Inspection. The Flight Safety Division is one of several offices under the Directorate of Aerospace Safety, and consists of Bomber/Transport, Fighter, and Research and Engineering Branches. The first two of these branches break down into Bomber, Transport, Defense Fighter and Tactical Fighter Sections, and it is to these offices that the project officers for every aircraft in the USAF inventory are assigned.

Specific tasks for a project officer can vary quite widely and are difficult to define since much depends on the accident picture of the aircraft he monitors. One facet of his work is accident investigation or observation of the investigations performed by other units. He must also analyze, evaluate, and accomplish the final review of accident reports and make appropriate recommendations to supervisory personnel. Preparation of accident briefs and of the annual summaries are also part of this activity.

Project officers are required to attend many meetings: system phasing group meetings, mockup reviews, configuration control boards, flight manual conferences, and other meetings concerning safety problems. In preparation for these he must review all types of Unsatisfactory Reports, Operational Hazard Reports, Incident and Accident Reports, and other sources of data to detect trends or indicators of accident-potential areas.

A third general area is the accomplishment of Project Officer visits, Staff Assistance visits, Safety Surveys, Safety Study Research visits, and the Monitoring of Safety Surveys, all of which provide the media for coordination with the using commands, the system support managers, contractors, and many others, to establish a common understanding of items of mutual interest.

Occasionally he writes articles for AEROSPACE SAFETY and AEROSPACE MAINTENANCE SAFETY



magazines, TIG Briefs, and other publications which are supported by safety agencies.

In order to keep in touch with aircraft from the tiny 0-1 to the huge C-5, a project officer must talk to the commanders, staff officers, aircrew members, safety directors, maintenance personnel in all categories, engineers, designers, and others. These efforts generate the visits referred to in the letters of notification. Upon arrival he will brief the commander to explain the purpose and scope of the visit. He can be expected to make an informal exit briefing before leaving to discuss pertinent observations and pass on comments. No written report is submitted to the unit or the command except as noted below. There are usually four or five items of specific interest to discuss on a visit, but, invariably, many other items come up which can result in some positive assistance by the Directorate of Aerospace Safety. During the time on station he will want to talk *freely*, *frankly*, and *informally* about operating conditions and problems being encountered with the equipment. He is vitally interested in your problems and will do his level best to help.

Back home, the project officer will prepare a Contact Report (an internal means of letting the chiefs know the what, where, why, when, who and how of the visit) which does not go out to the field. In the event some formal action is necessary, based on his observations and conversations, this item will have been discussed during the exit briefing and is forwarded for action in separate correspondence to the appropriate agency. Most often the problems can be solved by more informal means, such as discrete telephone calls, recommending that responsible agencies study the situation and correct it themselves.

The agency that needs to take action is often not the organization visited. The complete staff job for a project officer is to detect, advise, and monitor. Then, when a problem is solved or on the road to a solution, he can start looking for the next area of potential mishap; there are always more problems waiting for attention.

Here are some examples of problems in which project officers become involved: The T-37 spin recovery situation was improved by a recommended flight test program; the tire and wheel failures on the B-58 resulted in retrofit with nonfrangible wheels, which have since recorded several "saves"; the number of F-100 accidents for which the cause was undetermined was decreased by improved maintenance of the flight control and autopilot systems. Some current problems being worked on are the deficiencies in the C-133 fleet, attitude indicator malfunctions and warning systems in practically all aircraft, and the spin recovery situation for the B-57. There are many others.

A project officer can accomplish useful work for the organizations concerned with an aircraft only if he is given access to or can detect the problem areas. His prime method of operation is in the interest of flight safety and accident prevention and must be founded on the free exchange of ideas, procedures, problems and corrective methods. If this free interchange does not exist, his hands are tied, and the services of the Directorate of Aerospace Safety to the USAF are severely limited.

The goal of all safety organizations is to bring the accident rate (regardless of the criteria used to compute it) down to the final goal of ZERO. This is almost impossible, but in order to come close, the combined efforts of personnel at every echelon are essential. Let's keep the channels of communication *open*, *honest* and *free* to help achieve this goal. Accident prevention is not an end in itself; rather, it is a means through which training can be accomplished and combat effectiveness maintained throughout the United States Air Force with a minimum loss of personnel and equipment.

For additional information on project officers, see the following two pages. ★

YOUR MAN AT NORTON

The officers whose pictures appear on these pages are "Men from Norton," as described in the preceding article. These aircraft project officers of the Directorate of Aerospace Safety may be reached by writing to the symbol shown with each group of photographs or by calling the telephone extension number. The correct address is Dep IG for Insp & Safety, USAF (symbol), Norton AFB, Calif., 92409. Below each photograph are the individual's name and his aircraft assignments. As new project officers are assigned, AEROSPACE SAFETY will keep you informed.

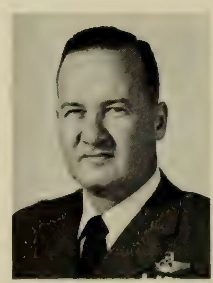
Bomber Section

AFIAS-F-1A
Ext. 4133, 3416

Lt Col I. D. Rothwell
B-58, SR-71

Lt Col Harold E. Brandon
B-52, XB-70

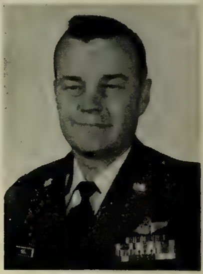
Lt Col Eugene J. Budnik
B-57, B-111



Lt Col Harold T. Stubbs
B-47, B-26, B-66

Transport Section

AFIAS-F-1B
Ext. 6284, 6258

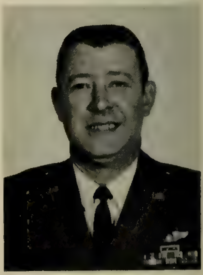


Col James S. Keel
C-54, C-5A, C-121,
T-29/C-131

Lt Col Wallace H. Carter
C-124, C-118, U-3, 4,
5, 6, 7, 10. Aero Club

Lt Col Robert E. Englebretson
C-47, 0-1, T-34, T-41, HU-16
All helicopters

Lt Col J. D. Oliver, Jr
C/KC-135, C/KC-97, C-140,
T-39, VC-137



Maj William M. Bailey, Jr
C-141, C-133, C-130, C-119
C-123, XC-142, X-19

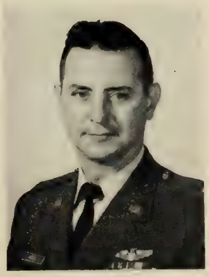
Tactical Section
AFIAS-F-2B
Ext. 6778, 3886, 2277

Lt Col Robert F. Brockmann
F-104, F-4

Lt Col Robert W. Cunningham
F-100

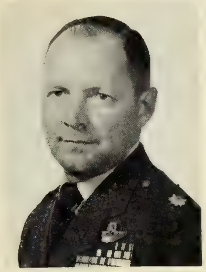
Lt Col Norman H. Frisbie
F-4

Maj James H. Broussard
F-105

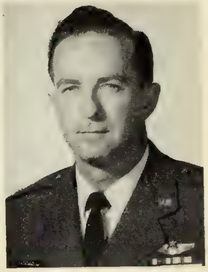


Maj Marshall D. Norris
F-100

Defense Section
AFIAS-F-2A
Ext. 6244, 3015

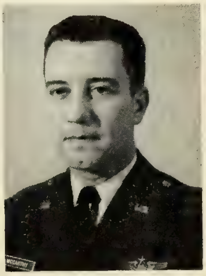


Lt Col Thomas J. Cribbs
F-111



Lt Col Jack R. Pulliam
F-5, T-37, T-38

Maj Donald R. O'Connell
F-101, F-89

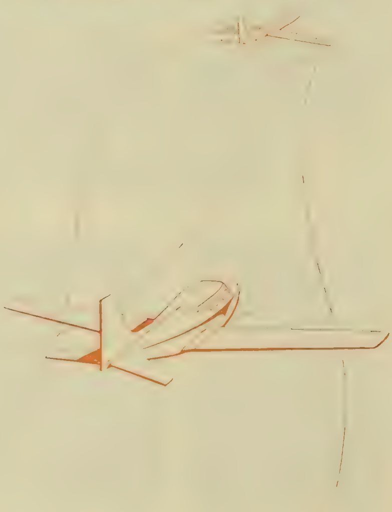


Maj Francis J. McCarthy
F-102

Maj Guy J. Sherrill
F-106, F-86, T-33

Maj Frank J. Tomlinson
A-7A, A-1E, T-28
OV-10A

WAKE TURBULENCE



■ FEDERAL AVIATION AGENCY ■

For years turbulence generated by aircraft was attributed to "prop wash." The "prop wash" behind other aircraft caused some pretty rough rides, "go-arounds," some accidents and was the subject of a lot of "hangar flying."

With the advent of the large jet transport and helicopters, the dangers associated with vortex turbulence were greatly emphasized and the so-called "prop wash" problems enlarged to include "jet wash" and helicopter "down wash" turbulence. By this time, however, the problems associated with aircraft wake turbulence had been broken down into two categories — "thrust stream turbulence" and "wing-tip vortices."

What was once thought to be "prop wash" was in fact vortex turbulence. "Prop/jet wash," i.e., thrust stream turbulence, can be a hazard to aircraft operating on the ground and pilots should take normal precautions to avoid taxiing closely behind larger aircraft making an engine runup or running up when other smaller aircraft are close behind them, as the case may be. At distances of 400-500 feet "prop" or "jet wash" normally will not constitute a serious hazard to other aircraft operating on the ground. Also, it should not be a hazard to aircraft in flight except possibly in the case of a takeoff or landing in the immediate area of an aircraft making a ground runup.

A vortex core is the center of a trailing mass of disturbed air created by the wing of an aircraft as it produces lift. An aircraft creates two such vortices with rotational air movement. As a lift-producing air foil passes through the air it leaves a continuous sheet of unstable air behind the trailing edge. Due to spillage about the wing tips, the air rolls into two distinct vortices, one trailing behind each wing tip. The rollup process is normally complete at a distance equal to about two to four times the wing or rotor span of the aircraft — about 200 to 600 feet behind the aircraft. If visible, formation of the vortex cores would appear approximately as shown in Figure 1.

Vortices generated by the rotors of a helicopter are shed and trail along the track behind the aircraft in the same manner as those generated by a fixed wing aircraft. These vortices have the same internal air circulation as those generated by fixed wing aircraft and have the same effect upon other aircraft.

When an air foil passes through a mass of air and creates lift, energy proportional to the weight being lifted is transmitted to the mass of air. Generally, the greater the lift, the greater the energy transmitted to the air mass in the form of turbulence. The turbulence is directly related to the weight, wing span, and speed of the aircraft. Its intensity is directly proportional to

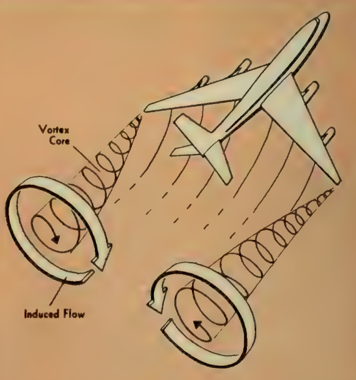


FIGURE 1.—Example of wing-tip vortices initial formation. (Once formed, vortices extend and may be hazardous for an undetermined distance behind the generating aircraft.)

the weight and inversely proportional to the wing span and speed of the aircraft. The heavier and slower the aircraft, the greater the intensity of the air circulation in the vortex cores. Thus, it can be seen that modern large transport aircraft will create vortices having maximum rotational velocities during takeoff and landing at or near maximum gross weights.

There is no current practical knowledge that can be used as a yardstick to accurately measure the period of time vortices will be a hazard to other aircraft. Studies have been conducted and measurements made of the size of vortices and velocity of the air within them up to nearly three minutes after passage of large aircraft. Pilots have reported what they believe to be vortex turbulence five minutes and more after passage of another aircraft. No practical rule involving a time interval for one aircraft behind another will assure avoidance of the vortices generated by the first. However, other methods of avoiding the hazards associated with aircraft vortices are known and can be applied by pilots.

"Why should I avoid flying in or through the vortex turbulence behind large aircraft?" is a question that a pilot might ask if accustomed only to the turbulence created by light single- and twin-engine aircraft. Perhaps the best answer, and the most impressive one, is that the aerodynamic forces applied upon the light aircraft by the circulation of air in the vortices and the pilot's attempt to counteract it could result in the airframe design limits being exceeded and possibly structural failure.

And then there is the pilot who has always been able to control his aircraft through any "prop wash" he has encountered. His excellent ability may mean nothing because the forces he encounters behind a heavily loaded large aircraft could exceed the control capability of his aircraft. A roll, descent, or combination of the two could continue even though full control travel or power is applied. The forces of the air in wing-tip vortices can well exceed the aileron control capability or the climb rate of some aircraft. For those who want figures, the air in a vortex core can produce a roll rate of about 80 degrees per second which is about twice the roll rate capability of some light aircraft when using full aileron deflection. If the light aircraft stayed directly between the center of the vortex cores from a heavy jet transport it could encounter a downward flow of air of about 1500 feet per minute. A light aircraft with a continued climb capability of 1000 to 1200 feet per minute could go only in one direction —*down*. Caught in such a position the pilot who altered his course could get caught by the roll forces or a combination of downward and roll forces. These forces have been sufficient to cause aircraft to do one or more complete rolls, to force them into the ground and in some instances a combination of the two actions.

The best way of avoiding the vortices hazard is to know where they are most likely to be encountered and act accordingly. Since vortices are not formed until lift is produced they will not be generated by an aircraft taking off until just before lift off — at the point where rotation is made. Vortices cease to be generated by a landing aircraft when its wing ceases to produce lift — when it has actually landed. However, remember that a large aircraft could have taken off and be out of sight, or landed and be on the ramp and the vortex turbulence could still be present near the runway.

Another factor to remember is the vertical and lateral movements of vortices. Vortices generated more than 100 feet above the surface will drop nearly vertically in a no-wind condition until reaching a height equal to approximately one-half the wing span of the generating aircraft. At that point they start to curve outward and spread laterally away from the track of the aircraft. There is one other thing that must be remembered, that is — both the vertical and lateral movement of the vortex cores will be affected by and move with the encompassing air mass. A crosswind will displace the vortices from the vertical in their downward travel and affect the lateral rate of travel. A crosswind component of approximately four to six knots, depending upon the lateral rate of vortex travel, is sufficient to cause one core to remain laterally stationary over a line on the surface while the opposite core will travel at its own lateral rate plus that of the effective crosswind.

HOW TO AVOID WAKE TURBULENCE

Unfortunately, the best advice is not always the most practical. In the case of vortex turbulence hazards avoidance, to insure 100 per cent success would require pilots, particularly those flying relatively smaller aircraft, to refrain from operating in areas where the very large and heavy aircraft regularly operate. It would produce the desired result but would not be practical. The following suggestions are therefore offered on how best to avoid wake turbulence:

- *General Rule*. When it is necessary to operate behind a large heavy aircraft try to remain above the flightpath of that aircraft. Remember that vortices settle toward the surface and also that they are affected by the wind and move with the air mass down to within 100 or so feet from the ground before spreading laterally away from each other and that the wind will continue to affect the vortex cores until dissipation occurs. Because of the infinite number of different circumstances that can exist, it is not practical to establish a set of inflexible rules. Therefore, we have outlined several possible courses of action and included their depiction in Figure 2, which, depending upon existing conditions and types of aircraft, pilots may wish to consider.

- *Takeoff/Takeoff*

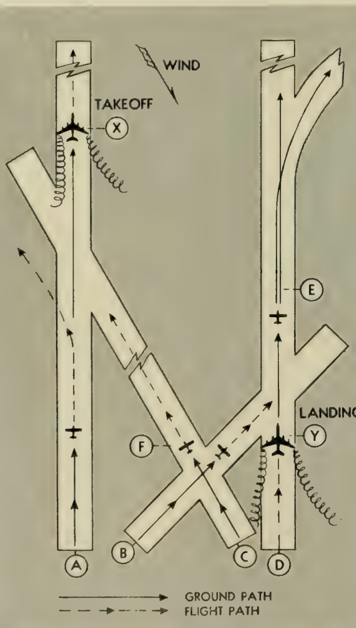
(a) Same or parallel runway. Start the takeoff roll at the end of the runway so that your takeoff will be before the point where the previous aircraft's takeoff was made. Make a normal performance takeoff and climb and you should be behind and above the settling vortices of the preceding aircraft. Don't depend upon the wind to dissipate the vortex core circulation appreciably unless it is 10-15 knots or higher and even then it could take several minutes. Also, remember that the lateral movement of vortices, even in a no-wind condition, may place a vortex core over a parallel runway. With a light crosswind one vortex can remain stationary over the ground for some time, or even move upwind, before dissipating to any significant degree.

WAKE TURBULENCE continued

(b) Intersecting runways. If the large aircraft was still on the ground until well past the intersection and your takeoff will permit climb to approximately 100 feet or more before you pass the intersection, you should not encounter either the vortices or any appreciable thrust stream turbulence. Remember the general rule and make certain that you cross above the flightpath of larger aircraft. Also remember that the larger aircraft will probably have a high gross weight at takeoff and thus will generate vortices of maximum intensity. Also, consider the lateral movement of vortices and the possible effect the wind will have upon that movement.

- *Takeoff/Landing*

(a) Same or parallel runway. When taking off after another aircraft has just landed, plan to become airborne beyond the point where the other aircraft landed. Remember, while starting takeoff from an intersection may keep you out of the vortices of an aircraft that has just landed, it could place you in the vortices shed by one that took off several minutes before on the same or a parallel runway.



LARGE AIRCRAFT	SMALL AIRCRAFT	
	TAKEOFF*	LANDING*
TAKEOFF at X	B, D, C, A	D, C, B, A
LAND at Y	A, C, E, B	A, B, E, F

FIGURE 2.—Example Takeoff/Landing Alternative courses of action.

(b) Intersection runways. The precautions to heed when taking off after another aircraft has just landed on an intersecting runway are the same as those for a single or parallel runway. But don't forget the "heavy" that may have taken off from either your runway or the other one within the past several minutes.

- *Traffic Pattern.* Don't fly below and behind a large aircraft in the traffic pattern. If practicable, plan your pattern to stay laterally separated from large aircraft by at least several hundred feet. When on the final approach, an above and behind position should keep you clear of the turbulence created by the preceding aircraft.

- *Landing/Landing.* The same above and behind position on final approach will place the light aircraft pilot in a good position to touch down beyond the point where a preceding large aircraft landed, length of runway considered. If the runway has a visual approach slope indicator (VASI) system, a flightpath in the "red and white" or with the top bar appearing a bit pink will keep you on or slightly above a normal glide slope. The *Airman's Information Manual* contains a complete description of the VASI system.

- *Landing/Takeoff.* When landing after the takeoff of a large aircraft, make a normal landing near the approach end of the runway and be solidly on the ground before reaching the point where the large aircraft took off. Although vortices from the departing aircraft will not be formed until the point of rotation, remember that the wind can cause the turbulence to move down the runway toward you.

When operating in the vicinity of an airport, you may receive an advisory, "CAUTION WAKE TURBULENCE," etc., warning you that it may exist because of an aircraft that recently made a takeoff or landing. When you receive such an advisory, don't hesitate to request further information if you believe it will assist you in analyzing the situation and determining the course of action you wish to take.

Remember, even though a clearance for takeoff or landing has been issued, if you believe it safer to wait, use a different runway, or in some other way alter your intended operation, ask the controller for a revised clearance. Sometimes air traffic clearances include use of the word "IMMEDIATE." For example, "CLEARED FOR IMMEDIATE TAKEOFF." In such cases, the word is used for purposes of air traffic separation. The clearance may be refused if you believe another course of action would be better suited to your intended operation. The controller's primary job is to aid in the prevention of collision between aircraft. However, he will assist you in any way he can while accomplishing his job.

Information on this subject may also be found in the *Airman's Information Manual.* ★

Missilanea

THE "GO-GO" SUPERVISOR. You know him – the boss man in action. The supervisor who attacks his job with the thundering animation of a maddened bull! It's like a three-ring circus. It can even make you feel that, because you are not making all this fuss, you are not giving your maximum energies to your job. I'm sure you are familiar with this type – one who is reluctant to delegate authority and who tries to impress his superior that he is indispensable, and that without his presence, the primary mission would collapse.

Much too often, the individual who literally throws himself into his work is accomplishing very little. He may have good intentions, but for all the results achieved, he might as well be out playing golf. Tackling a job calls for an orderly sequence. Size up what's to be done; develop a plan to include the safest and most efficient way of accomplishment – then do it! None of this calls for arm flailing or hollering; conserve your energy for the task at hand.

Human relations are an important factor in supervising. None of us like to work side by side with a bloodless supervisor who never comes up for air. Not that healthy enthusiasm for the task at hand isn't a desirable trait. A smile, a cheerful answer to a question, help create a better working atmosphere. It is in such an atmosphere where friendly understanding and mutual cooperation promote the highest degree of safety.

Lt Col A. C. Eggleston
Directorate of Aerospace Safety

CORROSION CONTROL – MINUTEMAN. While troubleshooting a Minuteman (LGM–30A) launch facility during site shutdown, a missile maintenance team discovered four to six inches of water on the floor of the second level equipment room.

Water damage to the motor generator, two RFI filters, and the power signal distribution unit necessitated the removal of these items for inspection and repair. Cause of flooding was attributed to a clogged rattle space drain pipe from the second level equipment room. Clogging occurred at the 90 degree elbow that connects to the sump drain line. Analysis of residue taken from the drain pipe revealed a gummy-like substance apparently caused by a mixture of paint and water.

It was suspected that over a period of time this accumulation resulted from the flow of water over painted floor areas into the drain pipe. *Review of maintenance records indicated that the last corrosion control at this particular site was accomplished on 29 Sep 65, at which time the drain was visually inspected.*

T.O. 21M-LGM-30A-6 does not require inspection of the rattle space drain; however, locally produced site inspection checklists establish this requirement. Additional corrective actions taken by this particular unit were: (1) inspection of the rattle space drain was included in the site inspection checklist used by staff officers, QC&E personnel, field supervisors and work center supervisors; and (2) similar checklists are being made available to mobile teams and specialists for their use. In addition to the above, this unit is recommending that both inspection and clean-out of rattle space drains be included in corrosion control 180-day site inspections.

Other possibilities may exist which can cause the same condition indicated by this unit. Debris from corrosion control operations can very easily find its way into the drain system with the help of a little water seepage. *Chipped or flaked paint, as well as other debris, should be carefully cleaned up after each corrosion control operation.* ★

Lt Col A. F. Zalonka
Directorate of Aerospace Safety

AEROBITS

HANDY HANDLE — During flight in an RB-57, the rear seat observer dropped a map. When he bent over to pick it up, he automatically reached for something to hang on to. What he grabbed was the right hand seat grip. He pulled and off went the canopy.

This sort of thing doesn't happen every day, but it is one of those hazards that is with us every time we get into a cockpit. The unit involved is making some canvas bags for map stowage which may prevent another such incident.

LIGHT DAMAGE — As the C-119G was inbound on a night GCA, the pilot made a correcting turn to the left prior to intercepting the glide slope. When he attempted to roll out, he discovered the aileron control was locked in the left turn position and the aircraft could not be rolled level. A 360-degree turn was made before the crew discovered the cause of their difficulty — the copilot's C-4 spotlight was hanging by its extension cord and had wedged between the yoke and the wheel. Attempts to turn the wheel to the right only wedged the light tighter.

The noise caused by cracking of the light case caught the copilot's attention and led to discovery of the problem. A greater left roll permitted removal of the light and there was no more trouble.

T-39 INSTRUMENT READINGS DURING FINAL APPROACH—A recent message from the field reported fluctuating flight instruments in T-39 aircraft. These occasions of erroneous instrument readings have occurred while the aircraft was on final approach in light to moderate rain. In each case the vertical velocity indicator fluctuated erratically or remained at zero, with the altimeter reading in error as much as 200 feet. At times only one set of instruments have been affected. At other times both pilot's and copilot's instruments were involved. When the alternate static source has been selected all instruments have stabilized. However, since there is always some error due to static source location, to continue an instrument approach under this condition could be hazardous.

This is the first reported discrepancy of the T-39 static system which indicated high fluctuation of the vertical velocity indicator. The most probable cause is defective static ports caused by dirt in or around the ports, paint around the port area, or the ports themselves distorted by wear or improper cleaning. Anything that changes the smooth plate area around the ports will cause errors in static pressures.

An engineering investigation of this problem is now underway. In the meantime, to protect against this condition, all units possessing T-39 aircraft should insure properly operating static systems. Systems should be checked for loose fitting connections, cracked or corroded tubing, and special emphasis should be given port areas for obstruction or elongation of static port holes.

Lt Col J. D. Oliver, Jr
Directorate of Aerospace Safety

WRONG SWITCH — A recent T-39 mishap occurred when the copilot moved a cockpit switch without looking at it. Upon returning to home station, the aircraft started an enroute penetration under ATC control. During the descent, in weather, the right AC generator OFF warning light came on, followed shortly by total electrical failure. After several wild gyrations the aircraft broke out of the bottom of the overcast at 500 feet. Visibility was approximately ½ mile in fog and rain. Flying around below the clouds with no instruments and with the windshield icing up, the pilot was unable to locate an airfield or determine his location. He became concerned about the amount of fuel remaining in the tanks, so elected to land, gear down, in a stubble field. During the landing the aircraft sustained minor damage but the crew and passengers escaped without injury.

Investigation of the accident led to a finding of pilot factor as the cause. All electrical components were operational. During the penetration the copilot had inadvertently turned off the *electrical master switch* while attempting to get the right AC generator reset and back on the line. During the ensuing checks and attempts to regain electrical power neither pilot noticed the OFF position of this most important switch.

Lt Col J. D. Oliver, Jr
Directorate of Aerospace Safety

MARTIN-BAKER SYSTEM — While installing the rear seat bucket in an RF-4C aircraft, egress maintenance personnel noted that the front seat personnel parachute withdrawal line connector was disconnected. With this line disconnected, the automatic feature of the parachute is lost—the drogue chute will not pull the personnel parachute from the seat if this line is separated. Unfortunately, this incident is only one of several reports concerning the F-4C escape system.

This condition presents a hazard to successful ejection, particularly if ejection is initiated at low altitude. At least one or two ejection fatalities per year are attributed to loss of automatic parachute function in all systems.

It was recommended that aircrews thoroughly check this item during seat inspection. Granted that a pilot is going to live longer if he preflights his aircraft, the responsibility for having it ready to fly still belongs to maintenance. The increasing frequency of discrepancies that would render the system inoperable is a matter of great concern.

The U. S. Navy and the RAF have compiled an enviable record of saves with the Martin-Baker escape system. During the last six years they have demonstrated a successful recovery rate of approximately 70 per cent below 500 feet. This record, however, has been achieved because the Martin-Baker has many added features that make it more complex than most current USAF systems, but such complexity will probably be necessary in any successful escape system. By definition, this requires increased maintenance efforts to insure maximum reliability. The AF has already experienced the costly replacement of a complex escape system because it could not be maintained in the field. This was costly not only in terms of dollars but in the tragic and irreplaceable loss of human life. We can ill afford a repetition of this experience.

Competent maintenance must be continually stressed to insure proper functioning of the escape system. F-4C egress system maintenance personnel should be thoroughly trained in all aspects of this system. Periodic refresher training is necessary to maintain their proficiency. To preclude maintenance errors, supervisors should assure strict adherence to checklists that have been developed for the F-4C escape system. No maintenance should ever be attempted without these checklists.

Robert H. Shannon, Safety Officer
Life Sciences Division

AEROBITS

THE FLYING SAFETY OFFICER will no longer have to beg, borrow or steal, and he may lose his reputation as a first class scrounger. Often hampered in performing his mission by lack of equipment, he now has a good thing going for him. It is a document titled TA-142, and its importance lies in what it authorizes for the safety officer in the way of needed equipment.

The new TA-142 lists the few pieces of equipment heretofore available through other tables of allowance, then adds a number of other long-sought items. It is part B of the new TA that is most significant and will be most welcomed by safety offices throughout the Air Force, because it authorizes 24 new pieces of equipment. Now all the flying safety officer has to do is place his order.

In addition to the equipment listed in TA-142, an interim message from SAAMA authorizes a movie camera as an additional item on the table of allowances. The camera, model 70DR, is a magazine loading 16mm. The TA also provides a projector.

All the newly authorized items are listed in the box on this page. For further information, see the April-May Flying Safety Officers' Kit which will include the entire TA-142. ★

TA 142

ALLOWANCES OF EQUIPMENT TYPE ITEMS

Aircraft Loadbalancing Computer
Fire Extinguisher, CO_2
Pick Axe
Fire Extinguisher, Water
Inspection Mirror
Dividers, Mechanical Drawing Type
Electric megaphone
Vehicle Warning Light
Gasoline Lantern
Siren
Mouth Examining Mirror
Magnifier

Binoculars
Triangle
Compass
Scale Draft Triangular
Drafting Compass
Drawing Board
Polaroid Camera Set
Motion Picture Screen
Motion Picture Projector
Strobelight
Recorder

FALLOUT

Continued from inside front cover

by USAF. However, it can be recovered if the recovery is started early.

I have been successful for a number of years in keeping my own pilots out of spins and have not resorted to the favorite restriction of setting an indicated airspeed limit as being the answer. They are taught to use that big hairy slab tail that got them into trouble in the first place. It is just as capable of reducing high angles of attack as it is in creating them. In other words, dump the stick smoothly before things deteriorate to a spin entry.

Major Jim Fox
352 Tac Ftr Sq
Myrtle Beach AFB, S. C. 29577

IT'S AFCS

Reference pages 18-19, March issue. I've long suspected a certain bit of confusion within AFCS Service Evaluation. Now I note they are using Systems Command aircraft.

Maj Herbert C. Metcalf
1994 Comm Sq AFCS
APO New York 09017

Please don't blame AFCS. The error is ours and we hope they'll forgive us.

LET 'EM LEARN

The article "Let 'Em Learn" (February) was most informative and I'm sure that all instructors cannot help but appreciate what Captain White has so demonstratively put in words.

As Officer Commanding the Primary Flying School at RCAF Station Centralia, Ontario, I have been subjected to a large turn-over of instructors, many of whom have never instructed before. Many heed the advice of the "old sweat" but others must learn the hard way. "Let 'Em Learn" has been included as compulsory reading for new instructors.

G. R. Hollinshead, Sqdn Ldr
Officer Commanding, Primary Flying School
RCAF Station Centralia,
Ontario, Canada

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WELL DONE

CAPTAIN HARRY M. BRENN

62 AIR TRANSPORT WING, MCCHORD AFB, WASHINGTON

Captain Brenn was the Pilot Flight Examiner on a scheduled military airlift mission from Elmendorf AFB, Alaska, to Shemya AFB, Alaska, and was occupying the left seat in relief of the aircraft commander. Cruising at 8000 feet, the C-124 Globemaster was encountering nearly continuous icing under night instrument conditions. The flight progressed normally until about 300 miles from Shemya when a slight vibration was felt, followed almost immediately by a violent roll to the left. The Nr 1 propeller reverse telelights came on and the Nr 1 fire warning light illuminated. Captain Brenn quickly ordered the Nr 1 propeller feathered.

Despite heavy control pressures, the uncertainty of what had happened and the necessity to use asymmetrical power, Captain Brenn was able to regain control while in a slight descent toward the ocean. At this point the crew discovered that Nr 1 engine had completely separated from the wing leaving the engine firewall to act as a tremendous drag on that side. It was necessary to use METO power on the three good engines to maintain a 600 fpm descent at 130 knots. The aircraft was buffeting continuously in a semi-stalled condition.

Captain Brenn declared an emergency and ordered the crew to begin jettisoning the 26,300 pounds of cargo and to prepare for a night ditching. Due to the buffeting, flight and engine instruments were unreadable and the crew was unable to stop the slow descent toward the sea. Under these severe pressures, Captain Brenn analyzed the situation and decided to divert to Adak NAS, 100 miles closer and with better weather than Shemya. Jettisoning continued rapidly. Within 20 minutes it was completed, and the crew briefed and prepared for ditching. Captain Brenn, continuously playing available power and control against the adverse forces, finally succeeded in holding altitude at 3000 feet at 130 knots. Contact had previously been made with the air/ground radio facilities at Shemya, Anchorage and Adak, and the appropriate agencies had been notified. The aircraft continued to buffet severely and several times appeared to be on the verge of a stall. Captain Brenn, however, managed to retain control and without radar, maneuvered the huge transport to a GCA approach at Adak. The final approach and landing were executed safely using standard three-engine procedures.

Captain Brenn, by his outstanding skill, flying ability, leadership and crew management, was able to save his aircraft and crew. Well Done! ★

BECAUSE
I FLY

1st Lt G. C. Norwood
FSO, 4765 Air Def Wg (ADC)
Tyndall AFB, Florida 32403

I

Rocking here
in my high chair
in my sky chair
I look down.
This electric Quiet
Never gets old
Startles my hands
Makes my senses collide
And they fall into a wordless heap,
Unable to survive
Unable to record
flight.

II

I have seen no mountain
High as my unreasoned flight,
Nor loved so thin a form
Nor lost so small a fight;
I have felt no chorus blend
As do we three out of here —
Nor been in unlived air
Nor killed something with cheer;
I have heard no pilot yell,
"Out here, your soul's unshod!"
Out here, God's not inside you, boy —
You are inside God.

III

Because I Fly
I laugh more than other men.
I look up
And see more than they.
I know how clouds feel
What it's like to have the Blue
in my lap
To look down
On birds
To feel Freedom in a thing called
the stick
Who but I
Can slice between God's billow-legs
And feel them laugh and crash with his step?
Who else has seen the unclimbed peaks?
The rainbow's secret?
The real reason birds sing?
Because I Fly
I envy no man on earth.

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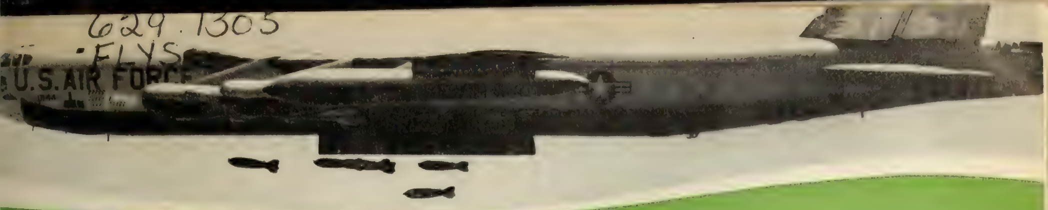
FLYS



AEROSPACE
SAFETY

UNITED STATES AIR FORCE

JUNE 1966

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AEROSPACE SAFETY

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FALLOUT

FLIGHT TESTING — 1966

While reading the article, "Flight Testing — 1966," in the March 1966 issue of *Aerospace Safety*, I noticed a ground safety discrepancy in the picture above the story.

Although the picture was taken to show the flight testing crew entering the cockpit area, the aircraft wheels are "not chocked." Also there is no indication of the aircraft being statically grounded to the designed or appropriately marked grounding point on the ramp.

Is the straight object hanging down between the nose wheels (landing gear) the aircraft's own static ground wire to dissipate static electrically after landing and taxiing?

In this picture which depicts the flight testing crew entering the cockpit area for flight, engine air intake plugs are installed. The pitot tube cover and streamer are still installed on the pitot boom, too. Maybe the air intake plugs are installed for classified reasons of the air intake area. The YF-104A aircraft pictures in 1954 had specially made intake cones in front of the main part of the air intakes to break up design pattern. Remember?

The cockpit entrance stand might also be held in a steady condition by the civilian employee at the base of the stand. The stand's individual wheel locks cannot be seen due to photo engraving halftone used.

In my opinion, I believe the YF-12A deserves the same sound safety treatment as other USAF aircraft receive. But, this aircraft probably is still in Lockheed control while undergoing USAF flight test certification and service evaluation. This I don't know.

This picture should illustrate a preflight condition for intent of flight prior to entering the cockpits. "A picture is worth a thousand words."

Thank you.

SSgt Theodore L. Willey
525 FIS Quality Control Sec
APO New York 09132

Sharp eyes. This was a stock photo not intended to convey a message of any sort.

WESTERN HOSPITALITY

The picture above the article titled "Western Hospitality" is of a YF-12A and not an SR-71. Note the ventral fin on the fuselage and the shape of the radome.

Let me take this opportunity to say that I enjoyed the article and am happy to hear that there are still a few citizens left who treat military folks doing their job with something more than cool formality.

Capt Richard A. Milburn
F-12 Project Officer, DSC/Materiel
Hq ADC, Ent AFB, Colorado

The story's the thing.

USAF AERO CLUBS

Your article "How Are The Little Guys Doing?" presented a summary of Aero Club accidents/incidents in the most informed light yet seen in a widely distributed publication.

I am one of the thousands of enlisted people who learned to fly and am licensed only because of the USAF Aero Club program.

(Continued on page 28)

1966...A Record Year For Accidents?

1966 is well on its way to becoming a year of catastrophe. If the trend continues we may end up with the worst Air Force aircraft accident record in recent years. While the statisticians tell us that such increases are the result of chance and are to be expected, this is small consolation to the men who are killed or to the commanders who must execute their missions with reduced numbers of men and aircraft.

Review of the accidents which have occurred indicates all too many are the direct result of irresponsible acts which can be prevented, if responsible agencies are alerted to the need for increased alertness in time.

Equipment can fail, maintenance people can make errors, weather can create hazards, airfields can be inadequate, designers can create poor equipment. These are acknowledged problems that cause accidents, and many people are working each and every day to correct such deficiencies. Pilots and their supervisors also are acknowledged problems and they are being worked on almost constantly to eliminate the accident potential. But, unfortunately, we cannot always ferret out and get rid of the people who will intentionally and knowingly show off or to try to prove that they know more than the guys who wrote the book. Neither can we afford the lenient, soft-hearted or irresponsible supervisor who won't take action against such individuals.

Rather than preach a sermon, let us examine excerpts from some recent accident reports; you can draw your own conclusions as to the amount of rational thinking, the sense of responsibility, the reliability and the integrity of the people involved in these accidents.

- A transport crashed on the runway and was destroyed while making a "spectacular" takeoff. The crewmembers were all killed. Fortunately, the load of passengers and cargo had just been off-loaded. Weather conditions were 600 feet scattered, 1200 feet overcast (ragged) with five miles visibility in haze. The aircraft became airborne somewhat beyond the computed takeoff distance, rotated rapidly to an estimated 70 degree nose-high pitch attitude and climbed into the overcast. It reappeared seconds later in an estimated 60-degree, nose-down pitch attitude and impacted 5,336 feet from the start takeoff point. The cause factor of this accident was pilot error. One salient point from the accident investigation report will be quoted for your consideration: "The pilot frequently used poor judgment and was inclined toward 'showmanship'. He enjoyed demonstrating maximum performance climbs, even with cargo and passengers aboard. Evidence indicates that at least five such maneuvers were performed in the month previous to the accident." The medical member's report included some personal information which revealed a definite inclination to the spectacular.

- A trainer collided with a radio antenna tower in a restricted area. The pilot was not authorized to be in the restricted area and was "burning off fuel to reduce weight." After the collision, the pilot climbed to altitude and bailed out. The cause factor of this accident was pilot error.

- Two bombers collided in mid-air and crashed. The four crewmembers ejected successfully. The aircraft were returning from a combat mission and the leader signaled for trail formation. Both aircraft completed a roll while in trail. The lead aircraft then began pull-up for a loop with the wing-man following. At the top of the loop, both aircraft reached low airspeeds and the pilots began vertical recovery maneuvers. The aircraft collided during the vertical recovery phase. There can be little question as to the cause factor, can there?

The examples cited are but three of far too many. The past year includes such beauties as a T-38 taking off with one engine inoperative; an F-101 flown by two pilots suffering from the after-effects of partying and a champagne breakfast; two bombers colliding while "combat maneuvering" through an instrument practice mission; two A1Es colliding when they "bounced" a pair of F-100s; and several cases of buzzing. All of these accidents were avoidable.

June is now staring us in the face. Last June was the worst month for accidents during 1965. During that month we managed to rack up 42 major and 8 minor accidents with 133 fatalities and 39 destroyed aircraft. This year's record to date has not been good. We cannot afford another June of that kind. This "end of the fiscal year panic" can be recognized and compensated for. To prevent avoidable and inexcusable accidents (and that's most of them) each must think rationally, exercise his assigned responsibility, demonstrate reliability and integrity in every facet of flight operation, whether it be maintaining, scheduling, supporting or flying the mission. The limited and decreasing number of men and aircraft available to the United States Air Force are critical resources which must be preserved. ★

PRECIOUS SECONDS

Capt Robert A. Anderson, 174 Tac Ftr Sq, Iowa ANG, Des Moines, Iowa

It's a beautiful July day at Podunk AFB. The weatherman reports a pressure altitude of 1280 feet and 90°F temperature. Galen 20 Tow completes his takeoff data card and local clearance form. Galen 20 Lead gives the briefing and details of the air to air gunnery mission. Following the briefing the usual bets are made by the ace members of the flight.

With the walk around completed, the J57 started, and all pretaxi checks completed, Galen 20 Tow is ready to taxi. Taxi checks are completed and Podunk Tower transmits: "Galen 20 Tow cleared for takeoff, runway 31, winds calm, altimeter 29.97." Military power checks indicate "go" and brakes are released. Throttle outboard, afterburner lights and gages check O.K. There's 150 knots and nose wheel liftoff. The F-100 lifts off the runway and accelerates to 180 knots. Gear handle up, now watch airspeed so that you don't exceed 190 knots which is max speed when the dart target is still under the wing.

In the next five seconds Galen 20 Tow lives a life time. The J57 flames out and drops from 15,000

The Answers

The questions posed by the author are valid, and the record suggests that the dynamics of ejection still need a lot of explaining.

Since the takeoff situation is fresh in mind, let's discuss this one first.

Captain Anderson is right in presuming that immediate ejection would, or, more properly, should be successful. This stems from the fact that the rocket escape system does have a proven on-the-runway ejection capability at 120 knots or higher. It is true, therefore, that immediate ejection should be successful.

Let's first understand clearly why we say such an ejection *should* be successful instead of *will* be successful. The answer lies in the fact that the present rocket seat provides about six seconds of time in trajectory in an on-the-runway ejection—and the parachute lbs of thrust to 5000 lbs of thrust in three seconds. The F-100 is 10 degrees nose-high, airspeed decreasing and a 33,000-lb aircraft approaching Newton's Law. Galen 20 Tow ejects immediately. The aircraft is still nose high, gaining altitude, has good flight stability and the wings remain level. The ejection is a complete success, thanks to the proper and precise action of the pilot.

Would the outcome have been different if the pilot had stayed with the aircraft a little longer? The aircraft would gain a little altitude as airspeed decreased, but would the pilot have made it if, as he ejected, the aircraft stalled and rolled 45 degrees to one side? Would this angle of bank cause the rocket seat to end up accelerating toward the ground instead of away from the ground in the last portion of the ballistic curve? This could have possibly placed the pilot at too low an altitude for successful parachute deployment.

Let us examine the prescribed procedures in the F-100 Dash One relating to this situation. It states that: If engine failure occurs on takeoff and the gear handle is up —EJECT. Also on the same page the procedure for low altitude ejection is zoom aircraft up and hold nose high attitude until airspeed reaches 140 knots or vertical velocity indicates zero and then eject. An examination of this procedure leads to the conclusion that if Galen 20 Tow had attempted to zoom, as stated in the Dash One, he would have stalled the aircraft during ejection. The F-100 has poor roll stability and has high sink rates when stalled. Would this angle of bank and sink rate cause the resultant of the ejection vector to end up lower than the actual ejection altitude? It certainly appears that this is true.

Then let's consider that Galen 20 Tow interpreted the first procedure to mean eject immediately. This could be considered a logical interpretation but if he had followed the second procedure the outcome might have been different.

The F-100 Dash One also states that with rocket ejection seat a successful ejection can be accomplished at ground level with 120 knots indicated airspeed. Then why are we still having low altitude ejection failures? Are we placing too much emphasis on the zoom procedure and forgetting the importance of aircraft attitude at time of ejection?

It appears that a complete study of the rocket ejection seat system is in order. This study should include the various effects on ejection of the various aircraft attitudes, i.e., bank angle, fuselage angle, sink rate, etc.

The pilot also needs more information about what the aircraft is going to do during these precious seconds: As, how long does it take the aircraft to decelerate from various speeds to stall speed under various weight conditions, configurations and temperatures? We need hard facts like these so that some of those precious seconds are not wasted on indecision.

Under certain conditions aircraft attitude at time of ejection appears to be critical. Then why can't the pilot maintain control of the aircraft with one hand and eject with the other? Would such a procedure inflict any serious injury on the pilot during ejection?

The answers to these questions could make more of these precious seconds living seconds, instead of fatal seconds. ★

---

opening sequence *should* take less than that. Specifically, the parachute should open and arrest the fall within three to three and one-half seconds.

But this timing has some presumptions in it. It presumes that separation is complete and immediate, for example, and that's a questionable presumption. We know that some people have managed to hold onto their seats in spite of the butt snappers—some with one hand, some with both. And the lanyard doesn't get pulled until and unless the seat moves two and one-half to three feet away from the ejectee.

So, delay in separation is a real possibility in any ejection, and when you have only six seconds available, there isn't much time to waste.

Next, the three second timing we cite presumes that the zero lanyard is connected. We think this is a fair presumption for the takeoff situation, because we believe that most people do hook it up when they strap in.

But please note this carefully: If the zero lanyard is not connected, the one-and-one system should also provide a chute in an on-the-runway ejection, because the total is only increased by one second—from about three seconds to about four seconds.

Now, who wouldn't agree that if the margin of time available for parachute opening can be increased—it should be? Well, the zoom maneuver is the means of doing this, and that is why the Flight Handbooks discuss it.

The principle of the zoom maneuver is so simple it's disarming. All it is saying is—ejection in a climb is better than ejection from level flight. Going further, ejection in a climb is the best situation possible, and ejection from a dive is the worst.

Certainly, if there are thousands of feet of air beneath, the value of the zoom maneuver is academic. It becomes important as the time to the ground becomes critical.

But let's get back to the takeoff situation and treat the questions Captain Anderson has raised.

First, he has, rightfully, identified some hazards that are implicit to the specific instructions he quoted. It is true that if 100 different pilots, with 100 different configurations, starting from a variety of airspeeds—tried to "zoom up and hold a nose high attitude until airspeed reaches 140 knots, or vertical velocity indicates zero"—there would be 100 different results. And some of them would look like spins.

Thus, it is far more important to understand what the Handbook writers *mean* than it is to memorize what they *say*.

We know what they mean. They mean, establish the best climb angle possible from the airspeed available, then eject at the peak of the trajectory. Knowing that cues are needed for identifying the peak of trajectory, they specified 140 knots or zero vertical velocity. The theory, of course, is that 140 is near the stall boundary —and they don't want the aircraft to stall. Similarly, zero vertical velocity marks the point where the climb ends and the fall begins. Obviously, this marks the highest altitude the aircraft will ever reach.

The same thing can be stated in a variety of ways; it has been. And most of them have been found to contain loopholes that lead to misunderstandings, too.

Take the statement that "the purpose of the zoom maneuver is to establish a launch vector rather than to gain altitude." Some pilots like this definition so well that they protest when anyone says "zoom for altitude."

The fact is that the zoom maneuver does everything. It establishes a climb angle, which is an upward vector. This results in a gain of altitude—at a rate which depends on the angle of climb and the airspeed.

This being true, the only question to be answered is—when is the best time, moment or instant, to eject? The answer suggested earlier was at the peak of trajectory.

So, once again, precisely where is this peak of trajectory? How is it best defined and/or recognized by pilots?

There simply is no single correct answer, because a peak climb angle (or vector), a peak altitude or a peak rate of climb can be defined, and ejection at the peak of any one of them would be successful.

There is, in our opinion, a distinct advantage in thinking in terms of peak climb angle rather than peak altitude. The reason is, simply, that peak angle can be recognized quickly and easily in a low speed zoom maneuver. It feels, and it is, exactly like a landing. When you reach the "stops" and the climb ceases to steepen—you are there. The airspeed will be approximately that for normal touchdown; the rate of climb will be at its peak value; and, if full aft stick were held, the next thing to happen would be stall, wingdrop and spin.

Since we are discussing a climbing situation, however, the airplane is not going to start falling immediately—nor must aft stick be held and a stall accepted. The airplane is through flying and should be turned loose so that it will stay upright and drift over the top of the ballistic trajectory.

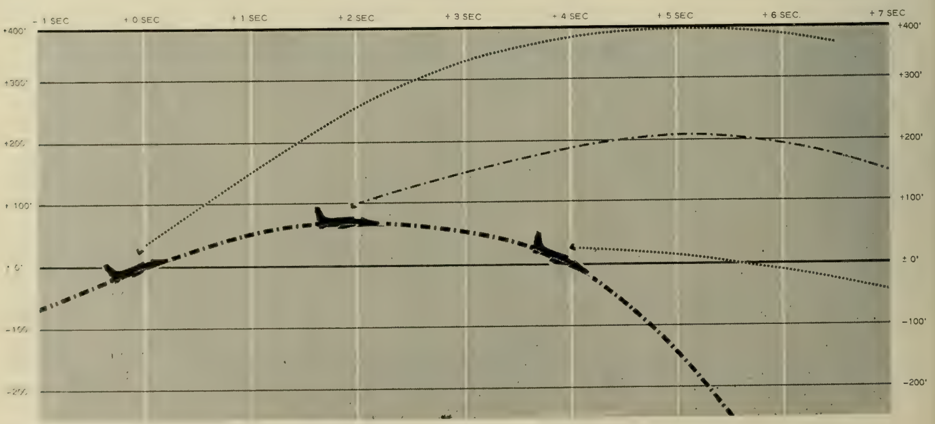
Certainly, if an airplane is going uphill at speeds like 120-140 or 180 knots, it is going to coast uphill for some moments before it tops out and starts falling. It will do this whether it stalls or not, whether it's spinning or not, and whether the pilot likes it or not. Mr Newton wrote that into law a long time ago.

If ejection is initiated at this point, the ejectee will have the same initial velocity and direction (which is upward) that the aircraft has—plus the boost effects of the seat. The geometry of such an ejection is shown in Figure 1. Note the trajectory of the man and seat on the left after ejection; it continues upward for quite a while before it curves downward.

If the pilot chooses to seek peak *altitude* before initiating ejection, he will have to be both careful and perceptive. Careful, because the airspeed will bleed off to values well below one G stall speed, which means that he must unload the wings with forward stick or trim to avoid stalling them out. And he will have to be perceptive to recognize the transition from climb to descent. True enough, it can be detected as rate of climb reaches zero.

Between instrument lag and the mechanical functions of ejection, however, if ejection is delayed until the V.V. indicator reads zero, the fall will have begun before the seat leaves the aircraft. Presuming you hit it on the nose, however, the trajectory of the seat is shown as the center illustration in Figure 1. Note that the man who ejects at the

Figure One



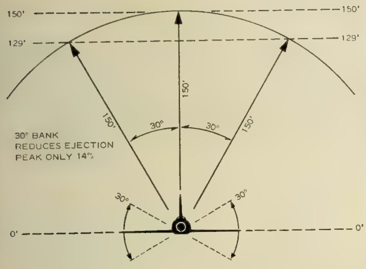


Figure Two

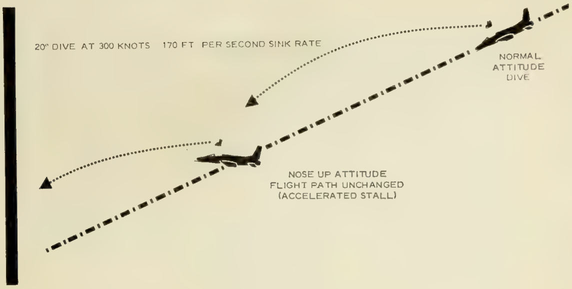


Figure Three

peak of the climb angle will actually reach a higher altitude in trajectory than the one who rides the aircraft to peak altitude—then ejects.

In order to be consistent, we have shown a third situation in Figure 1, the illustration on the right. This shows what happens if the cues that identify the peaks are missed.

The diagram is accurate, in that the nose of the aircraft points into the relative wind. If we didn't do this, meaning if we—or you—were to forcefully hold a nose up attitude in an airplane that is falling at sub stall airspeeds—the airplane would more likely be spinning than upright.

Which brings us to Captain Anderson's final question: What happens to the ejection geometry when aircraft attitude gets radical or out of control?

Having seen evidence of excessive concern over attitude, as well as some erroneous implications attributed to it, a strong comment is in order. That is, until and unless the pitch or bank exceeds 30 degrees, don't worry about it!

Figure 2 shows the effects of a 30-degree variation from vertical. The peak height is only reduced 14 per cent by a 30-degree angle. Thus, a seat that would bump a pilot 150 feet high if he were straight and level, will send him up 129 feet in a 30-degree bank.

But beware of thinking in terms of pitch attitude! There is no normal condition of flight where a 30-degree pitch attitude would not be either a steep climb or a steep dive. When ejecting from airplanes that are in 30 or 40 degree pitch attitudes—the effects of flight path on the overall ejection are almost invariably far more important than the effects of the attitude on the seat!

There is only one general situation in which the flight path of an airplane can remain essentially unchanged while the pitch attitude varies greatly, and that is in the case of true pitchup (or pitchdown). Here, and here alone can it be said that the seat vector is working against the airspeed to the extent that it affects the outcome of the ejection.

In a flying airplane—and that means an airplane that is flying within its range of flyable angles of attack—the proper frame of reference in discussing ejection is flight path, and the terms to be used are climb or dive. References to attitude should be de-emphasized, and here is a good example of why.

An F-105 pilot found himself in an overly steep rocket pass, not long ago, and he saw that he couldn't hack the pullout. Actually, he pulled the bird into the stall twice, then decided to eject.

That aircraft was in a dive, perhaps at 20 degrees or so. If it were doing 300 knots, (it was a snap-up delivery) his rate of descent was about 171 feet per second. Having read or heard that attitude was important in ejection, this pilot pulled the stick to the aft stop to achieve a "level attitude," and then ejected. Of course the airplane stalled! But, fortunately, it did not snap or spin.

As it happened, he made it. And he probably believed that the change in pitch attitude saved him. The fact is, however, that the time it took him to make this move cost him far more altitude than it gained him—no matter whether it took him half of one second to do it, or more than one second.

That airplane was approaching the ground at 170'/sec.—and changing the attitude to "level" in a deep stall condition didn't reduce that descent by any noticeable amount.

He did change the seat vector all right, from 20 degrees nose-down to level. Since the 'Chief still has the M-3 catapult, he actually changed the vertical component of the seat from about 61'/sec. to 65'/sec.

Surely, if he had realized that he was losing 170'/sec.—while he was performing a risky maneuver that could only reduce his descent by 4'/sec.—he would have ejected instead of pulling back on the stick.

Those are the facts about pitch attitude. Figure 3 shows the geometry of this particular situation. Think it over, and talk it over; the difference between the effects of flight path and pitch attitude is really important.

In order to eliminate loopholes in this discussion, here is a question: Should this '105 pilot have used the zoom maneuver in this situation?

We hope the answer is intuitive. If the aircraft can't be pulled out of the dive, how in heck can it be zoomed?

The one remaining unanswered question posed in the opener is: If the rocket seat has a zero level capability, why are we still having low altitude ejection failures? ★

DAMN the

PILOT LOSES PASSENGERS— THREE LEAP IN FOG . . . .

This headline appeared in the papers 31 years ago. There have been a lot of changes since then, but pilots today are learning the same lessons this pilot learned so long ago.

ORPEDOES...!

Vernet Poupitch, Directorate of Aerospace Safety

The winter was severe with numbing cold and unusually heavy snowfall. Life hadn't come to a complete stop, but nobody was out and about if he could help it. The only flying being done was that considered to be absolutely necessary.

Then, at the Army Air Corps depot at Olmstead Field, Middletown, Pa., we received a message saying that a fighter was grounded at Elmira, N. Y., for lack of an engine. "Would we fly an engine and maintenance crew to Elmira to make the installation?"

The aircraft and facilities in 1935 were somewhat primitive by today's standards, but there was a real "can do" attitude so a pilot and three mechanics were found to make the trip. While the pilot was making preparations, the depot truck backed up to the Bellanca transport and the crew loaded the aircraft with a spare engine, tool boxes and field A frames. Three mechs and an army hitchhiker completed the cargo. The pilot was cleared and the aircraft took off at about 10 o'clock in the morning headed north.

Elmira weather at the time was reported to be overcast with a 2600-foot ceiling, 10 miles visibility, temperature −10°F, with ice in the clouds.

At Sunbury, Pa., approximately 90 miles north of Middletown, the ceiling dropped to about 800 feet. Just north of Sunbury was the Eagles Mere Ridge, a small range varying in elevation from 1900 to 2100 feet, lying directly across the flight path. The ceiling dropped to zero over the Susquehanna River and all the passes. Just beyond Eagles Mere, the ceiling rose to 1600 and finally increased to 2600 over Elmira. As a last resort it would be easy to follow the iron compass into Elmira. There was no radio station at Sunbury, so the pilot could not learn of the lower ceiling until he got near enough to observe it. Now the decision had to be made whether to turn back and wait it out or poke into the weather.

The Bellanca had no wing de-icing equipment, but exposure to ice would last only a few minutes. Abort or complete the mission? The pilot quickly cranked the world's first computer—his brain. Does the answer he got seem familiar? It was, "Damn the torpedoes, the mission must go!" So he continued, climbing to 2500 feet into the soup and noting the time. He had verified his track and identified the last landmark. In six minutes, he would have crossed the mountain range and would let down until in the clear.

The Bellanca transport was a single engine, high wing, fabric-covered transport with fixed gear. One of the most efficient load carrying transport aircraft in the air, it could lift practically anything. Every external member, including the landing gear struts, wing struts and the fuselage, was a lifting surface, except the wheels and they were faired. The fuselage was shaped like a thick air foil section. In addition to the external structure that supported the large wing, there were streamline wires running from the bottom of the fuselage to the spars at about two-thirds of the span. A heavy, coarse, wire mesh separated the cockpit from the cabin. The temperature in the cabin was always ambient because it had no heat.

Just before going on instruments, the pilot checked the cabin with a quick glance and saw the hitchhiker huddled aft near the cabin door with the three mechanics, Sgt. Berry, Corp. Heimbauch, and Pvt. Smith, nonchalantly sitting along the side of the cabin. Berry, from Arkansas, was a medium size young man, wiry, high strung, a natural comedian, and a darn good crew chief. Heimbauch was shorter and younger, a little on the stout side, and a newcomer to the outfit. He had enlisted at Middletown. Smith was of medium height, slender, on the slow side, a good mixer, a tag-along type of an individual, and always broke. By the middle of the month, he was jawboned to the hilt. In order to satisfy his drinking urge, he would drink barracks shaving lotion not locked in the foot lockers.

The pilot, satisfying himself that the cargo and passengers were in satisfactory condition, proceeded through the clouds on instruments, noting from time to time the clock on the instrument panel while he held his course and altitude. The windshield frosted, then iced. That was expected, but not so soon. The side windows were still clear and he quickly observed his wing leading edge to be clean, so he was not worried—yet. Then there was a peculiar hum—he could hardly hear it at first—that developed into a deep howl. The wings were still clean, but that noise—it was different from anything he had ever heard before. This was no time to lose the engine. He concentrated on the instruments. Everything looked good. There was no vibration, but that howl was getting louder and louder. One more minute to go, then he would let down. Now, the side windows began getting translucent—but just hang on! That awful noise! What was it?

Finally, the six minutes were up and the pilot nosed down. At 800 feet, he was in the clear and *saw* the noise (the streamline flying wires had iced into what appeared to be one inch rope vibrating like strings on a bass fiddle). He took a deep breath of relief and turned his head to reassure his passengers. The hitchhiker and the engine were all he saw. Fearful of what may have happened, he quickly found an auxiliary field, landed, and proceeded to ask questions.

DAMN THE TORPEDOES!

The hitchhiker related the events as they occurred in the cabin.

Shortly after the pilot had checked the cabin with his sweeping glance and then went on instruments, Sgt. Berry was complaining of being cold, so he placed himself between Heimbauch and Smith. Heimbauch was sitting farthest aft. When the flying wires iced and began vibrating, the noise in the fuselage, amplified many times, scared Berry, and when he stood up and looked through the wire grate forward and saw the windshield iced and heard the howl rising in pitch, he panicked, shouting, "We're in a spin—get out!" and raced aft for the cabin door.

But round little Heimbauch was not asleep. He reached the cabin door first, crowded by Berry, Smith and the hitchhiker, pushing to get out! The doorknob had to be turned before the door could be forced against the slipstream, but somehow Heimbauch managed the manipulation. Out he went, but in the crowding, his parachute harness hooked around the inside doorknob! Poor Heimie, outside in the clouds, hooked like a quarter beef in a deep freeze, but very much alive, shouted and kicked to no avail. Berry, Smith, and the hitchhiker were clamoring to get out, each trying to outmaneuver the other. But, push as hard as they could, they could barely crack the door open. They had to free Heimie before they could open the door, so they kicked the doorknob hard with their heels and broke off the knob, saw the harness pull out, and proceeded to push each other out.

When asked why he didn't jump, the cold, frightened hitchhiker replied simply that there was no one left to push him out.

The pilot's concern now was the safety of his stampeding, jumping crew. He knew that over the mountains the clearance had been only 400 feet, and if any one of the three had delayed in opening his chute, he would buy the farm. The pilot immediately proceeded to the nearest telephone and reported to the Pennsylvania Highway Patrol, giving the route of his flight. After a short wait a patrolman phoned to say that two of the parachutes had been recovered. Heimbauch was alive but bruised, and Berry had only a sprained ankle. A little later Smith, about whom the pilot had the greatest concern, was reported to be okay. The pilot telephoned his home base, reported the incident and was told to return as soon as weather permitted while the crew returned via Pennsylvania Highway Patrol, after hospital treatment.

Now, from the serious side, what can we learn from the story? The pilot was good and had a lot of weather experience. He had been an airline pilot, flew depot flight tests in all type aircraft, had ample cross country time and was familiar with the terrain out of Olmsted Field. He was at home on instruments, and respectful of the radio range and their multiples, as well as of the eastern high tension lines strung across valleys, like clothesline.

If the crew had not stampeded, the flight would have been routine and there would have been no story to tell. From the flight safety aspect and good judgment, the pilot should have turned back to Olmsted when he saw the weather barrier. The success of the flight was not worth the odds of icing the wings and/or the carburetor. A delay of one or two days awaiting the weather would have made the flight routine.

This pilot was capable and would have been able to cope with any situation on this flight except wing icing. That, he did not encounter, but he did run into the unpredictable. And *he left no margin for error.*

Over the years pilots have learned many lessons. It's too bad that so many of their successors have to relearn those same lessons the hard way.

The pilot in this story learned a lesson that was engraved on his mind for all time: Crank in *all* the odds in your favor and allow yourself room to spare. ★

LEGAL OR SAFE?

Maj Francis A. Dellorto
928 Troop Carrier Group
Chicago-O'Hare Intl Aprt, Ill

"...BUT WE WERE LEGAL!"

I was riding with a pilot friend of mine the other day in his beautiful new Pontiac GTO. He was understandably proud, calling forth the eager horses to zoom down the highway. As we approached an intersection another auto made a half-hearted attempt at stopping, then proceeded onto the highway directly in front of our galloping steed. This didn't bother my friend at all. Blasting his new trumpets, he continued at the same speed. The other car stopped halfway across the road and our splendid vehicle careened around and sped on merrily. My friend was very perturbed about this intrusion and when I asked him why he hadn't slowed down or stopped, his retort was, "I had the right of way, I was *legal.*"

This brought to mind many such incidents that happen while we are in command of many more horses than the GTO possesses. I mean the *flying machine.* How many times has ground control cleared us across a runway and we galloped across without checking to see if the approach end was clear? How often has the tower cleared us to take the active and hold, and again without checking the approach, we whipped out onto the runway eager to roll? How often have we been cleared to land while one and a half miles out, and, although we saw another aircraft holding on the runway, our approach was continued because after all *we were* cleared to land. We were *legal.*

All of these incidents reveal an inert tendency in us humans to perhaps want to go outside the realm of the law, but also to want everyone else to think that we are *legal.* We feel that since the controller has cleared *us* it is then up to the other fellow to watch out.

Let's look closer at the word *legal.* It is a word meaning lawful, legitimate, basically implying strict conformity to the law. Definition of the word *legal,* although broad and lengthy in the dictionary, does not say anything about *safety.* It follows then that making an instrument approach at minimums is *legal* but it is not necessarily *safe.* Many things should be taken into consideration.

Is the weather up or down? Does it go from 200½ to 100¼? If so, you might have a tendency to go lower than you should and inadvertently break minimums while concentrating on the approach.

Is the air smooth or rough? Two hundred and a half in smooth air can be more or less routine, but in turbulent air extremely difficult. It's legal! But, is it safe?

Is there heavy precipitation? Two hundred and a half in heavy rain or snow is legal. Is it safe? You have to rely on wipers and clean windshields to allow you to even see half a mile.

Is there adequate approach lighting? This can make a big difference if you are cracking minimums.

How long is the runway? Two hundred and one half in heavy rain, landing on a 5500-foot runway might be legal but—!!

Is there a stiff crosswind? It's legal to land with a 40-degree crosswind of 15K and 200 and a half, but it would take a proficient instrument pilot, who is also a crosswind expert, to handle this situation. Many other items enter the picture, such as runway conditions, approach zone obstructions, icing conditions. When you are in doubt or when safety dictates, exercise your prerogative and divert to a *safe* alternate.

I know that from now on whenever I hear this word *legal* used in flying or driving that I personally will not use it as a synonym for *safety.*

* *

Although a driver (either aircraft or automobile) "has the right of way," he is not legal if he is involved in an accident which he could have prevented. The Courts call it "the last clear chance" or "subsequent negligence" rule. What is really meant is that if another driver has placed himself in a position of peril through his negligence, every other driver has the responsibility to avoid collision with him if possible and reasonable to do so. If such action is not taken by the legal driver, he has not taken advantage of the last clear chance to avoid the accident and could be charged with subsequent negligence. ★

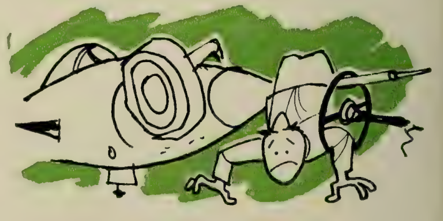
Rex Riley

CROSS COUNTRY NOTES

CLOSE CALL—The B-52 was on the low level portion of the mission when the crew spotted a light aircraft ahead on their course. Pull-up was begun immediately and the bomber missed the bugsmasher, but only by about 100 feet.

The above was taken from an OHR with the recommendation that general aircraft pilots be made aware of low level routes through various means. The fact of the matter is that information relative to these areas is available to civilian pilots, but there still remain some who wouldn't know an oil burner from a smudge pot. This means that it is up to Air Force crews to constantly monitor the surrounding area during these low level flights. Our aircraft aren't built quite like tanks and a little job can take one of our bombers out of the air very quickly. Incidentally, while you are keeping your eyes open to save your own life, you might save his.

IF THERE IS any one place where a driver should be extra careful, it is on the flight line. I've seen my share of tug races and other such nonsense on the ramp, but in general, the driving on the flight line is rather circumspect. Why, then, do we continue to have accidents in this area involving aircraft and other vehicles? Granted there is sometimes a great deal of activity, lighting is often poor and weather might be a factor, Rex believes that two factors are primarily responsible for these accidents. They are lack of knowledge and care. Let's examine a couple of recent examples:



- An F-101 was being towed from the trim pad back to the parking area, and a pickup truck with two men in it was on the way to the trim pad where another runup was about to take place. The driver of the pickup was driving down the center of the taxiway, which had been cleared of snow, when he met the vehicle pulling the aircraft. For just a moment he looked down at the light beam indicator on the instrument panel to see if his headlights were on high beam. When he looked up he saw that the approaching vehicle was a tug pulling an aircraft. By then it was too late. The pickup driver tried to avoid the aircraft, but the truck went under the left wing and a megaphone and rotating beacon on top of the truck cab scraped along the underside of the wing.

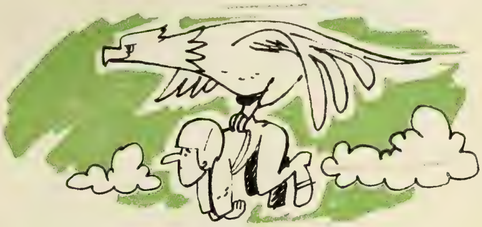
- A C-135 was being backed into the parking spot by a towing vehicle when the towing team chief noticed that the aircraft was getting close to a guy wire pole at the flight line perimeter fence. He signalled a stop and the aircraft was stopped with the nosewheel on a yellow taxiway clearance line. The vehicle driver told the wing walker on the left side that the nose of the aircraft had to be behind the yellow line. The left wing walker then cleared the operator to continue backing. Meanwhile the team chief was on his way forward to tell the driver to pull the aircraft forward. He signalled the driver to stop, but it was too late. The tail hit the pole resulting in a tear in the right elevator trailing edge. The cause factors (and investigators found several) center around personnel error, but certainly contributing was the fact that the hardstand on which the aircraft was being parked was not big enough for large aircraft because of the proximity to the fence and pole. The pole has since been removed, which is like closing the barn door after the horse escaped.

Rex relates some of these occurrences each month not to embarrass anyone nor because he thinks we have a lot of idiots around the flight line. But the facts are inescapable: we continue to have a lot of these type mishaps due not only to the actions of people, but to the location of equipment and facilities that makes an accident almost inevitable. Every day there are a lot of close ones that do not result in accidents because some sharp-eyed gent sees the hazard in time. This is where Rex thinks the flight line troops can make the Air Force a lot of money. When you see one of these obstructions, how about telling your flying safety officer about it? At least YOU will know that he has been made aware of it and you can bet that he will do whatever is in his power to have the threat removed.

PETE PIGEON was desperate. Unless he could get a message through, a lot of his buddies were going to wind up as entrees for a bunch of hawks. Pete was fast, and he was leading the pack in the big homing pigeon race. But about 50 miles from the starting point, with a five-mile lead, he had been attacked by the hawks and barely escaped with his life.

The hawks had orbited high in the sun and dived on Pete as he flew along, his mind intent on navigating precisely to his home coop. Fortunately, he had seen the lead hawk in time and dived into a nearby cloud. The weather was very cold and the cloud pretty wet and Pete had iced severely, making it difficult for him to remain aloft. With his wings heavily iced, and his vision fading from a coat of ice, he had fluttered out of the bottom of the cloud determined to get off a message on guard channel to the nearest radio to warn the rest of the pack behind him.

But Pete was out of luck. Guard channel was cluttered with conversation between the station and a pelican yakking about fishing conditions in Lake Erie. The warning never got through and the hawks had a feast that day.



The OHR filed by a fighter pilot read thusly: "(The other aircraft) broadcast on 243.0 mc UHF emergency frequency for approximately 20 to 30 minutes to .... control tower with constant chatter concerning a weather report, telephone numbers, etc. . . . This appears to be a completely unnecessary use of guard frequency. Availability of other facilities, frequencies and equipment made this unnecessary. .... Flight service station serves .... tower and has adequate UHF frequencies. . . . I wonder why .... tower did not suggest a different procedure."

Rex wonders too. If you are one of those who is contributing to guard channel becoming garbage channel, we hope you don't wind up as the pigeon.

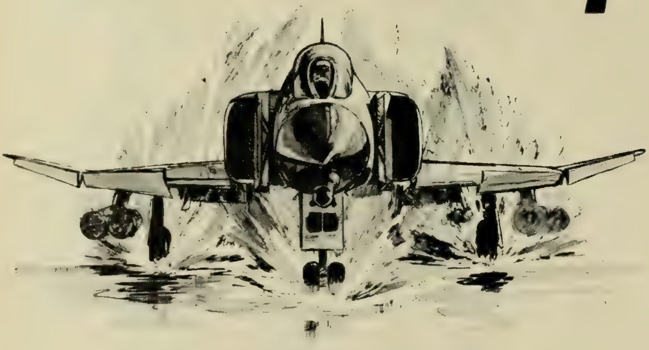
PRIMARY CAUSE—Supervisory Factor. The instructor pilot failed to insure the gear was down and locked prior to landing. A contributing cause was operator factor in that the pilot failed to lower the landing gear.

This appears to be one of those heads up and locked situations but let's not ridicule these pilots. It could happen to you. In this incident the pilot had not flown for six months and was being requalified. Six successful touch and go landings had been made without incident but on the seventh it finally happened: they forgot the rollers. There aren't any lessons here that countless numbers of pilots haven't already learned, but Rex feels obliged to preach a little.

There is plenty of evidence in the records that when numerous touch and go landings are being made, the probability of forgetting the gear gets real good. IPs especially should make it a habit to check and recheck in these situations to prevent that most embarrassing of moments to a pilot.

THE F-4 AND A

Wet Runway



Capt Jerauld R. Gentry, Edwards AFB, Calif.

The abnormally high accident/incident rate of the F/RF-4C type aircraft on wet runways added impetus to a test program accomplished at Edwards AFB during the last five months of 1965. We were directed to determine the aircraft performance on a wet runway and define the optimum techniques which would result in the shortest stopping distance. I use the term "stopping distance" in preference to landing roll as we were especially concerned with aborted or refused takeoffs at high speed.

Our test vehicle was RF-4C serial number 63-7743 which was especially instrumented for the tests. Wheel rpm, brake pressure, and anti-skid signal were recorded on an oscillograph, and a centerline camera pod photographed each of the three gear during the runs. Two photo theodolite cameras tracked and recorded each run to give us instantaneous velocity and deceleration.

Prior to each test our fire department would lay a test strip 50′ wide and 8000′ long with a mixture of 200 parts water and one part foam. This resulted in a maximum depth of .05 inch and an average RCR of 17. As soon as the fire department completed the strip, the tests would start.

The refused takeoffs consisted of accelerating the aircraft at various gross weights (43,000–52,000 pounds) to arrive at the desired abort speed just as the wetted section of the runway was reached. The landing tests were similar, in that the aircraft was landed just as close as possible to the beginning of the wetted section.

The initial tests brought out the importance of tire design. On one of the first runs, which was a no drag chute, refused takeoff at 42,000 pounds gross weight, I aborted at 140 knots and used maximum aerodynamic and wheel braking. Eight thousand feet later I was still whistling along at 100 knots. Our computed stopping distance was 12,000 feet. The stopping distance under similar conditions using a drag chute was 7700 feet; and remember, these distances did not include the 2000+ feet required to accelerate to abort speed! Naturally we were quite concerned with these results. The tests were repeated with similar findings. A McDonnell team tried it in their airplane and wound up with a slightly longer distance.

We then learned that we had not been using the optimum tires. We had been testing three-groove tires, which were to be replaced with the four-groove General tires. In addition to the extra groove, the General tire had wider grooves thus allowing a greater volume of water to escape from under the tire. The tests were resumed with the new tires and approximately a 40 per cent reduction in stopping distance was attained. I hope the directive to use the wider grooved tires wherever wet runways may be encountered is being followed.

(There is no special federal stock number to differentiate between the three groove and the four groove tire. The three groove tires will be used stateside until the supply is exhausted. All overseas supply requests will be filled with the four groove tire.)

The results shown in the chart are corrected to 2300 feet pressure altitude, 10.4 degrees Centigrade, and an RCR of approximately 17. In addition, the refused takeoff distances are from 140 knots and do not include the distance required to accelerate to that speed. These data represent over 60 test runs and correlation with the Dash One is not too good. The Flight Manual landing roll data appears 70 per cent optimistic with a drag chute and 29 per cent optimistic without a drag chute. Our final report, soon to be published, will be used to correct the landing charts, and give additional information in the takeoff section. It is evident from the data below that takeoff planning for a wet runway is more critical than is presently indicated in the Flight Manual.

It is interesting that only a small increase in stopping distance results from a 10,000-pound increase in gross weight. Also it appears that a barrier engagement is inevitable on most runways if drag chute failure follows a high speed abort. Fortunately McDonnell has given us a reliable drag chute system.

The techniques that resulted in the shortest stopping distance were basically those outlined in the Flight Manual. Both throttles were chopped to idle at touchdown or when abort was initiated; the drag chute, if used, was deployed; the stick was pulled to the full aft position; the speed brakes were extended, and maximum anti-skid braking was used until the aircraft stopped. The flaps were left extended as this not only increased drag, but reduced idle thrust due to boundary layer control operation. The importance of flying the Flight Manual recommended "on speed" approach to touchdown cannot be over-emphasized. Several landings were made with a "flared" touchdown and this resulted in an increase in ground roll of 400 feet due primarily to a delay in wheel speed-up immediately after touchdown.

Because of many system malfunctions, there has been considerable reluctance to use nosegear steering. This feeling is certainly justified; however, on a wet runway with a crosswind, nosegear steering may be the only thing that will keep the aircraft on the runway. When I did not use nosegear steering, I experienced difficulty keeping the aircraft in the 50 ft wide test. Using rudder for directional control above 100 knots proved effective; however, in the speed range of 70-90 knots the F-4 has a tendency to fishtail with maximum braking on a wet runway even without a crosswind. This fishtailing is disconcerting to a pilot and cannot be adequately controlled using rudder or differential braking. Differential aileron/spoiler action only aggravated the fishtailing tendency, and of course, differential braking lengthened the rollout. Consequently, we recommend engaging nosegear steering just prior to brake application. Proper maintenance and TCTO 608 to improve the reliability of the system should remove the hesitation to use nosegear steering.

Hydroplaning was mentioned many times during the test period. There are at least two types of hydroplaning: dynamic (hydrodynamic theory) which is primarily a function of water depth, tire pressure, and velocity, and viscous (lubrication theory) which is primarily dependent upon the runway surface texture and fluid viscosity.

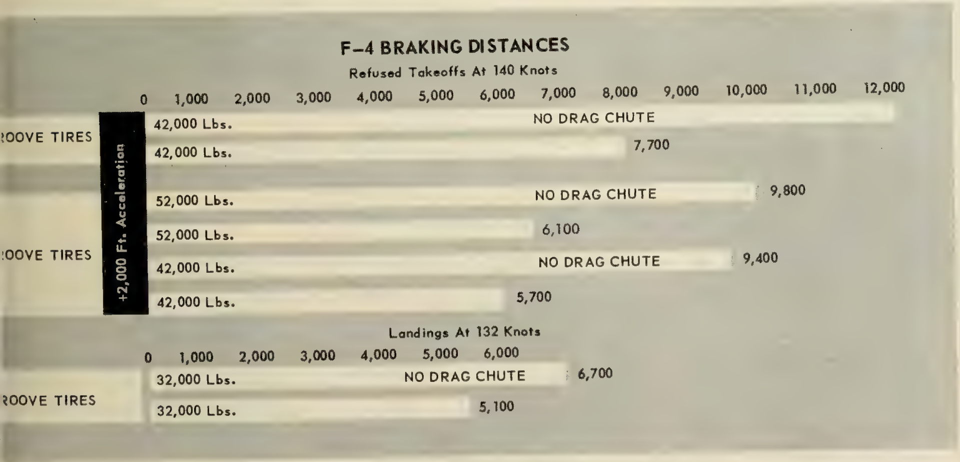
Initially we believed that we might be experiencing the more common total dynamic hydroplaning. Tire pressures were significantly varied as a check, but no improvement was noted. Our data indicated that we never encountered total dynamic hydroplaning. Viscous hydroplaning, to some extent, is probably always present on a wetted surface.

Brake effectiveness at high speeds on a wet surface is very low. The coefficient of friction doubles as the aircraft decelerates from 140 to 100 knots, and doubles again decelerating to 50 knots. There was little or no apparent deceleration that I could feel when applying maximum braking at high speeds. In fact, the airplane seemed to accelerate when maximum braking was applied without using the drag chute. This sensation can readily be interpreted as an anti-skid or brake failure, and the temptation to turn the anti-skid off and revert to manual braking may be strong. This action should be delayed, if possible, until the aircraft has decelerated to 60-70 knots. Anti-skid cycling was always apparent below 75 knots and was sensed as high as 100 knots with the heavier gross weights.

To recap our recommendations for stopping the F/RF-4C on a wet runway:

- Fly an "on speed" approach and touchdown as close to the end of the runway as practicable.
- Immediately after touchdown deploy drag chute, engage nosegear steering for directional control and apply wheel brakes.
- Use maximum anti-skid braking until stopping is assured.
- Configure the aircraft with as much aerodynamic drag as possible.

CAUTION: During strong crosswind conditions, if the drag chute is causing directional control problems, jettison the chute when it no longer gives effective deceleration. ★



Jet jocks sometimes have to be briefed on the mixture control, tailwheel, and other peculiarities of the old fashioned recips. But it's all part of learning to . . .

Hunt With A Bird Dog

Maj Karl K. Dittmer, USAF

Spotter plane, O-1 Bird Dog, flies low over jungle to spot enemy. Keeping target in sight while staying out of fighter's way is just part of the day's work.

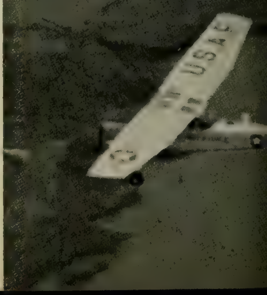
"That crosswind was a little rough. Even with full rudder the bird almost got away from me. I made another takeoff and started to bug out of the pattern to go do some airwork, but changed my mind. I wasn't about to let that little airplane get the best of me."

The speaker, a Major, was talking about one of the lesser known Air Force aircraft—the Cessna O-1 *Bird Dog*. Until recently, the *Bird Dog* belonged to the Army and the Major to a TAC F-100 squadron as its operations officer. At present, the Major is one of my classmates here at Hurlburt Field, Florida, where we are going through the 4410 Combat Crew Training Wing's O-1 Aircrew Training Program (ALO/FAC). The backgrounds of the pilots going through this program are as varied as there are missions in the Air Force. We have two combat ready F-105 pilots, two more F-100 types, B-52 pilots, training command instructors, you name it.

Three weeks from now we'll be putt-putting over the jungles and rice paddies of Southeast Asia looking for the Viet Cong—"Charlie," they call him. The idea, as I get it, is to form a blanket of O-1s over the area so Charlie can't wiggle without being spotted by one of us. Once we spot him, it will be up to someone else to try and wipe the smile off his face. We carry 2.75 rockets with Willie Peter (white phosphorous) heads plus a handful of smoke grenades. We'll use these to mark the target and direct the strike. To an ex-fighter pilot this is like making love by proxy. But it does beat flying a desk.

Fully loaded, the O-1 tips the scales at less than 2500 pounds (2800 in SEA). It is little different from most of the equipment we've been flying. For some students it is their first encounter with a tailwheel and the first time many have had to really use rudder.

Bird Dog pilot surveys dam
Low and slo



Ground handling is similar to the old T-6, except you can see over the nose. In the air it handles like no other bird, except the L-19. It is short-coupled and the "ball" seems to detest the center. I found it necessary to feed rudder in ahead of aileron both rolling into and out of turns. In the turn itself, I usually need a little rudder with the turn. The amount varies with angle of bank, direction of turn, power setting and the time of day. In some respects, the O-1 is like a Gooney Bird—easy to fly without bashing, but difficult to fly with smooth precision. Landings are best made tail wheel first and truly smooth ones are worth crowing about. About the time someone thinks he has it tamed, it produces some bounces that would make a mustang envious.

Our instructors are returnees from SEA tours in the *Bird Dog*. They hand out a lot of good, solid first-hand information in addition to showing us how to mark targets, navigate with one finger on the map and handle the machine without popping any rivets. Some are full time instructors while the rest are here on a four month TDY tour. Our maintenance people are mostly TDY troops also. This creates its own peculiar brand of problems, and the operation runs reasonably smoothly in spite of the problems.

Our training program was well planned. They gave us two weeks of ground school on air to ground operations, counterinsurgency, and other subjects slanted at the operation over there. We spent one afternoon on the aircraft itself, understandable, since all systems are about as complex as the spring steel landing gear. Of note: someone asked what a magneto did and someone else wanted a rundown on the mixture control. Neither man had ever flown behind a prop!

White phosphorus grenades fired from O-1's spot targets for fighter bombers. Sighting system is primitive.

The flying training program started with two-hour transition missions. Most of us got three flights in one day and "soloed" on the second ride. Soloing isn't always that easy. My instructor told of one student who had never flown an aircraft where he needed to use the rudder pedals for anything except for the wheel brakes when taxiing. They actually had to teach him basic flying fundamentals before they could turn him loose. As a matter of fact, they made us go through a few stall series, slow flight, and had us try lazy 8s and other coordination exercises before we started shooting stop-and-go landings. Stop-and-gos we shot by the gross. In fact, we needed a minimum of 130 landings to graduate. When traffic is light you can get 20 in an hour. Transition was followed by a low-level cross-country with emphasis on navigating by grid coordinates. A night transition ride and check-out was followed by a proficiency check.

Next came tactical training—marking targets and controlling fighter strikes. This means trying to hit the ground with our 2.75 inch rockets and smoke grenades.

"Ah, Hot Flash Lead, do you have my mark?"

"I have your mark, Pigeon."

"Rog, well, ah, the target is 200 meters southeast of my mark."

"Nice shooting, boy."

The *Bird Dog* has no sighting system other than some home-made chewing gum-and-grease pencil device they installed here at Hurlburt. However, we manage to get tolerable accuracy, more-or-less, shooting from the hip.

During our tactical training one thing became evident. This machine doesn't unroll anyone's socks during the pull up from a rocket pass, and it is a terrific zoom indeed that gains back 500 feet of altitude. It ain't no fighter, despite that big 213 horsepower mill.

While directing strikes, one of the more pressing problems we had was keeping the target in sight while at the same time keeping out of the fighters' way. We had to use a different technique for each type fighter and for each kind of ordnance. One can't standardize it—there are too many variables. The best we could do was to stay loose and play it by ear. In fact, that seems to be the name of the game over there. Throughout the training program our instructors kept on us to stay flexible and to THINK. They stressed that we'll be on our own in SEA and will have to make our own decisions, often weighing the importance of a target against weather and other factors which affect the relative risk.

The people here in the O-1 program are doing a good job of providing a practical training environment. Further, they have managed to do it safely. I notice that they didn't beat us over the head with safety, but did keep things under reasonably tight control—you know, constantly monitoring the wind, weather and us dumb students. As usual, it has paid off. There have been a few ground loops and other close calls, but, to date, no one has broken any of the little airplanes. ★

Pilots just being introduced to the O-1 and A-1 aircraft might do well to read the article on torque on page 22, especially if your experience has been limited to jets—Ed.

ridge by fighter bombers.
of the game.

Save $12,000,000 in 1966

Lt Col Harold E. Brandon, Directorate of Aerospace Safety

No, there's nothing wrong with the title of this story. We mean twelve *million* dollars. Now if you are one of those fellows thinking that you can't save 12 dollars, much less all those millions, you are the guy I want to talk to. You and I and a lot of other people can save the Air Force twelve million dollars during the remainder of this year, and it won't even be very difficult.

I can see that you are a skeptic and that I'm going to have to show you. Fair enough. But to digress just a moment. No doubt you are familiar with the tremendous efforts to prevent aircraft and automobile accidents. Commanders constantly stress flying safety and the Air Force is really going all out to decrease the number of lives lost in automobile mishaps. These efforts have paid off as evidenced by the steady decline in our aircraft accident rate during the past 20 years.

Now, let us examine another area, one that is costing the Air Force millions each year, plus an unnecessary loss of lives. During the two-year period, 1964-65, there were 141 aircraft accidents *on the ground*. Some were classified non-flight, while others fell into the flight category because there was intention to fly. (This article covers only those mishaps classified as aircraft accidents. In 1964 alone, 128 aircraft were damaged in *ground* accidents—which is another accident category.) Because of the extent of damage, 61 of these were considered to be major accidents. And these alone cost more than forty-eight million dollars. We didn't compute the cost of the 80 minor accidents.

This is where we get the $12,000,000 figure: These on-the-ramp accidents are costing about four million dollars a month. Multiply the monthly figure times the second six months of this year and you can see that our $12 million figure is pretty realistic.

By now you've figured out that all we have to do is prevent about 15 or 16 accidents during the remainder of this calendar year. But who do we mean by we? An analysis of cause factors reveals that most of the accidents of the type we're talking about are caused by Maintenance and other personnel error. Maintenance people were involved in the majority of the personnel error accidents, while drivers of support and other equipment accounted for the remainder in this category. In fact, errors on the part of maintenance and other personnel, pilots and supervisors accounted for 74 accidents, or more than half the total. The accompanying table provides a complete breakout.

Only a moment's inattention is required to produce a scene such as this. Damage from mishaps on the flightline cost USAF millions.

To give you some idea of how you and I can prevent these accidents, here are some briefs of mishaps that have occurred but shouldn't have. You will see that carelessness, ignorance and indifference were the main culprits.

- A T-33 was being serviced with oxygen. Unqualified personnel attempted to fill the low pressure system from a high pressure oxygen cart. Result: fire and explosion, causing major damage.
- A crew chief was running up engines on a C-130 when the aircraft jumped the chocks and collided with another C-130. Both aircraft were destroyed. The crew chief failed to properly set up the hydraulic panel and turn on the auxiliary hydraulic pump.
- An unqualified airman lost control of an F-101 while taxiing to the trim pad. The aircraft left the taxiway and hit a mud bank. Cause factor was maintenance supervisory personnel.
- During a Coco alert, a B-58 skidded off an icy runway. The result was fire and destruction of the aircraft. The cause factor was supervisory personnel who failed to consider all existing runway conditions during a Coco alert.
- A T-29 collided with a ground power unit causing explosion and fire resulting in major damage. The cause factor was pilot error, in that he failed to properly clear the area prior to taxiing.
- A C-131 was struck by a refueling truck. The driver of the refueling truck fell asleep and allowed the truck to collide with the parked aircraft.
- A B-52 crew was taxiing in preparation for takeoff when brakes and steering were lost. The pilot turned off anti-skid and pumped brakes; however, the brakes were ineffective and the aircraft traveled 438 feet farther and collided with a parked KC-135. Cause was maintenance

Photo is dramatic; loss was tragic when C130 burned. During a two-year period there were 141 aircraft accidents on the ground.

supervisory error, in that the jumper wires were not removed from Nrs 1, 2, and 4 hydraulic pack turbine control relays. The wires were placed on the packs during prior maintenance.

- The operator of a de-icer vehicle with the boom raised to a 45-degree angle drove under the wing of a C-119. The boom struck the wing. Cause, maintenance error.
- A B-52 was returning from a routine night training mission when it struck an unlighted, unattended fire truck that was parked on an active taxiway in violation of current Air Force directives. Cause factor was listed as pilot error; however, unit supervisors were negligent in approving parking of the vehicle in the path of taxiing aircraft. Controlling agencies, including the crew, that could have prevented the accident were not notified of the parked vehicle.
- A C-124 was being refueled when fire broke out and destroyed the aircraft. Primary cause factor was attributed to maintenance error, in that the quick disconnect of the F-6 refueler was not secured properly.

In order to reduce these costly accidents during 1966 it is essential that commanders and supervisors of maintenance and operations activities insure that published directives concerning ground operation of aircraft, vehicles and equipment on the flight line, are complied with at all times.

To further reduce this staggering cost in dollars and loss of equipment and lives, each individual associated with aircraft and supporting equipment has the personal responsibility to re-examine his qualifications, habits, procedures, and methods of performance in an effort to eliminate safety malpractices and potential hazards.

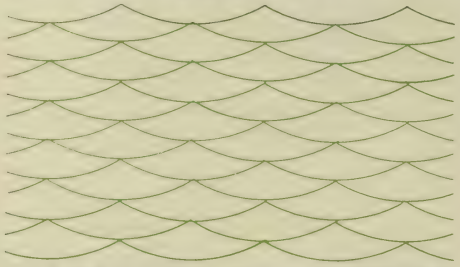
Now do you believe that you can help the Air Force save twelve million dollars during 1966?★

BREAKDOWN OF ACCIDENTS BY CAUSE FACTOR

	Pilot Factor	Maint. and Other Personnel Factors	Weather	Supervisory	Materiel	Other
MAJOR	7	20	5	8	15	6
MINOR	6	29	5	4	26	10
	13	49	10	12	41	16
				TOTAL		141

If you are an aficionado of the water sports, learn . . .

THE THREE Rs OF WATER SAFETY



Robert L. Savage, Hq ASD, AFSC, Wright-Patterson AFB

Author checks lifesaving device for pet of Freda Lazenby, daughter of Owen Lazenby of Wright-Patterson Safety Office. Mr. Savage, training officer for 2d Coast Guard District Auxiliary, recently received State of Ohio award for contributions to boat safety.

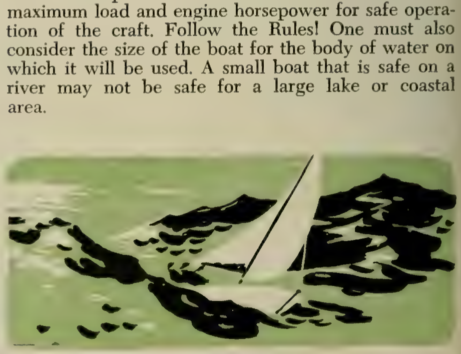
The frantic upsurge in water sports during recent years has brought a correspondingly steep curve in water accident statistics. The drowned and the maimed add up to a grim total of largely preventable accidents. Preventable, that is, had the participants taken the time to learn something about the lethal environment and equipment they coveted in haste.

The outboard engine, a lightweight "kicker" used mostly by fishermen until a few years ago, has grown into a monstrous, roaring, smelly juggernaut. Driven at full throttle by landlubberly children, paramours, alcoholics, and grandmothers, all without an hour's training, it has changed the waterbug's way of life, forced new laws to be written, and driven a wedge of misunderstanding and distrust between those who have one and those who don't. In its wake comes the water skier—a virtual unknown fifteen years ago; and deep below him, the SCUBA diver pokes silently into the mysterious (and lethal) depths.

If you are already involved, or are about to take up one of these sports, you owe it to yourself, you owe it to your progeny and you owe it to your fellow water lovers to learn something about the handling of boats, and water safety.

Learn the "Three R's." In this case, they are RULES, REGULATIONS and REQUIREMENTS. And if at all possible, attend one of the free courses in boat handling offered by the United States Coast Guard Auxiliary or the United States Power Squadron in your area. If you don't know how to contact them, write to the Chief Director of Auxiliary, U.S. Coast Guard, Washington, D.C.

Everyone who operates a boat must realize his responsibilities; there are basic rules which must be followed. Sufficient freeboard (the height of the boat hull sides above the water line) and a safe hull design in seaworthy condition are the prime requirements for a safe boat. Each operator must be familiar with the handling characteristics, capacity and safe speed for his boat. Some manufactured boats have a small metal plate near the transom which states the maximum load and engine horsepower for safe operation of the craft. Follow the Rules! One must also consider the size of the boat for the body of water on which it will be used. A small boat that is safe on a river may not be safe for a large lake or coastal area.



State and federal laws require certain safety equipment to be on board your boat when it is used on the waterways. Most important is an approved life saving device in serviceable condition for each person on board. This may be a life jacket, life vest or a buoyant cushion approved by the Coast Guard. Buoyant cushions are not approved for children, and some states require that children under 12 years of age wear a life jacket at all times while on board a boat. It is good practice for a boat operator to insist that non-swimmers wear life jackets. For all others, life saving devices must be located so they are quickly available in an emergency.

FUEL HANDLING

One of the major causes of boating accidents is careless handling of fuel. All permanently installed fuel tanks must be vented so that the vent line terminates at the exterior of the hull. Filler pipes must be mounted flush with the deck and positioned so that spilled fuel can easily be washed overboard. Gasoline fumes are heavier than air, of course, and all closed compartments must be vented with two cowl ventilators.

If you are operating a boat with closed compartments, you are urged to contact the Officer in Charge of Marine Inspection, in the Coast Guard District in your area, or a member of the Coast Guard Auxiliary for specific ventilation requirements for your boat.

If your boat is equipped with an inboard engine, there is a cardinal rule that must be followed: *Before you start your engine, open all motor hatches or covers.* If it is equipped with an exhaust blower, allow it to operate for a sufficient length of time to remove any accumulated fumes from the bilge. And please don't install your own make-shift electric wiring; there is always the danger of gasoline fumes aboard. All electrical circuits must be fused, and open type switches are out. Even the battery should be covered with a non-conductive material, since a carelessly handled tool or metal object might touch the battery terminals and cause an electrical spark.

Outboard motors with portable gasoline tanks are so designed that the tank can be removed from the boat to be filled. These portable tanks should never be filled in the boat; if ignited during refueling operations the fumes and spilled fuel could create a terrific explosion. Remember—gasoline is more dangerous than dynamite! So take the time to be careful.

FREE BOAT INSPECTION

The U.S. Coast Guard Auxiliary offers another free service to all boat owners who request it—a Courtesy Motorboat Examination. This examination determines whether the boat owner is complying with the law and the requirements of the Auxiliary for certain additional equipment which will entitle him to the Auxiliary Courtesy Examination Decal.

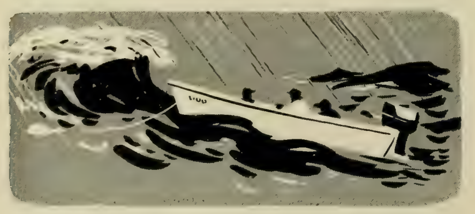
The additional requirements for this decal are to have on board an adequate pump or bailer, a paddle or oar on Class A boats, a distress flare, an anchor and line of suitable length for the locality, approved running lights in operating condition. The boat, of course, must be in ship-shape and seaworthy condidition. During this examination the Coast Guard Auxiliarist will point out all of the items necessary for making your boat safe for operation in the local waters. Since this examination is conducted only at the request of the boat owner, discrepancies in the examination are not reported. They are noted on the examination form which is given to the boat owner and he may correct them and receive the decal.

Having a boat in seaworthy condition and equipped with the required safety equipment is just the beginning. Boat owners also must realize they are completely responsible for the safety of their passengers. If you are operating on a large body of water, it is common sense to let someone know the time that you expect to return. In addition, give them a description of your boat and its registration number. This information will be helpful to the Coast Guard or other rescue organizations in the event your craft becomes disabled and fails to return on time.

THE THREE Rs OF WATER SAFETY

WEATHER CHECK

Before starting a cruise on open waters, check the local weather forecast. If the weather looks unfavorable, postpone your voyage until another day. In the event you are caught on the water during a storm, here is how to ride it out. First, keep calm; make sure each person is wearing his life jacket. Seat all passengers in the bottom of the boat to keep the center of gravity low, secure all loose gear, and head into the waves at a slight angle. Proceed at a speed which enables you to maintain a straight course, and prevents waves from washing into the stern of your boat. If your motor should fail, use a sea anchor made of a bundle of clothing, extra life jackets, or any other items that can be tied to a bow line, and throw it overboard. The sea anchor will float off the bow and create enough resistance to keep your boat headed into the waves.



The greatest danger in riding out a storm is to allow your boat to become trapped in the troughs of the waves. When this happens, the breaking waves fall over the side of the boat, filling it with water. When the boat is headed into the waves, this danger is lessened.

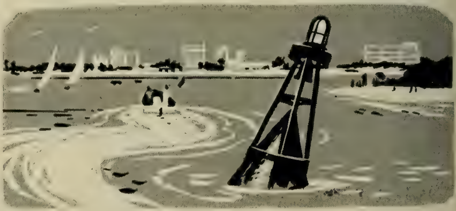
Whether you operate a boat on federal, state or international water, there are certain rules of the road which must be followed to prevent collisions. As an operator of a boat you are responsible to learn these rules and yield the right of way to other vessels when they are privileged.

When another vessel approaches in your danger zone, which is described as the area dead ahead to two points abaft your starboard beam, you must yield the right of way. When you are overtaking another boat, you must realize that the boat you are overtaking is a privileged vessel. You should insure that the wake or maneuvering of your boat will not cause any accident or result in the other boat being disabled. Your wake or waves are your responsibility, and you are liable for any accident or damage they cause.

NAVIGATION AIDS

There are various aids to navigation that will warn you of danger areas and guide you through safe channels. These aids are in the form of floating buoys, shore lights, wooden structures, and other colored markers.

Buoys are identified by shape and color; each has a meaning. Red buoys mark the right side of the channel, and should always be passed leaving them on your right side when entering from the seaward toward the head of navigation. Red buoys are cone shaped, and are called num buoys. If you can remember the three R's (Red, Right, Returning) you will have no difficulty in knowing on which side of the buoy to pass. Black buoys mark the left side of the channel, are called can buoys, and are shaped like a can. Buoys are numbered with even numbers on the red buoys and odd numbers on the black, and are identified on navigation charts by type and number.



Along the coastal areas there is a system of interconnecting canals, rivers, and bays known as the Intercoastal Waterway. The systems of buoyage and markings are the same with one exception—some portion of the buoys or markers are painted yellow. The western rivers of the United States (Mississippi and its tributaries) use a similar system of buoyage except that the uppermost portion of the buoy is painted white for ease of identification after dark. They contain no numbers or other markings. Wood structures are located on the riverbanks to guide the navigator through the safe channels. Each structure contains a number which designates the number of miles from a stated point of origin.

In order to maintain a sufficient depth of water for navigation, the western rivers have numerous dams. In order to pass from one pool to another, as they are called, it is necessary to pass through a lock. When locking through, the boat operator must be familiar with procedures.

First, when approaching a dam from the up-river side, the operator must maneuver his vessel toward the lock wall along the river bank. A river chart will specify where the dam is located and the location of the lock wall. A vessel approaching the lock must signal the lock master to be admitted into the lock. An adequate length of good line is necessary to hold your boat against the lock wall when the water level in the lock changes. The line should never be made fast to any part of the boat or the bits on the lock wall, but should be held by the occupants in the boat. As the water level changes the line is shortened or lengthened to keep the boat against the lock wall.

All occupants of the boat must wear life jackets during locking operations. The water within the lock becomes very turbulent as the level raises or lowers, and all safety procedures must be observed.

When boating near a dam, either on the up-river or down-river side, it is necessary to keep a safe distance away from the dam. If you are boating on the up-river side, always have your anchor ready in the event that your motor should fail. The current in the river will carry your boat into the dam if you have no means of controlling its operation. When boating on the down-river side of the dam, keep a safe distance from the dam since the current and turbulent water can draw your boat into the water which is spilling over the dam. Exercise extreme caution at all times when boating in the area of a dam.

WATER SKIING

Boating is a sport in which all members of the family can participate, and another water sport that has increased greatly—water skiing. This is a fun sport and also a dangerous sport if basic safety procedures are not followed. First, of course, the skier must wear a life saving device, preferably a life vest that will enable the skier to float with his head out of the water even though injured or unconscious. When towing a water skier, there must be a second person on board the boat to act as an observer. The boat operator cannot safely operate the boat and watch the skier at the same time. Hand signals should be used by the skier to communicate with the occupants of the boat, and all persons should be familiar with these signals.

Another water sport which has increased in popularity is SCUBA diving. Each boat operator should be familiar with the skin diver's flag, a square, red flag with a white diagonal stripe. When you see this flag displayed on a boat which is not underway, or attached to a float, it means there are skin divers in the water. Refrain from boating in that area, but if you must, do so at slow rates of speed. Be on the lookout for air bubbles coming to the surface of the water. These are emitted from the diver's breathing apparatus and signify that he is below. Exercise extreme caution; your propeller is a lethal weapon and can fatally injure a diver.

If you are a sailor who relies on Mother Nature instead of "horses" which drink gasoline, you will need specific instructions on sailing techniques. To become proficient in handling a sail boat requires experience, until you are familiar with its operation.

In summary, all the rules of water safety boil down to a simple maxim—"For more fun in a boat, use common sense afloat." ★

TORQUE: THE OTHER FORCE IN FLIGHT

Jet-trained pilots converting to single engine recips (0-1, A-1) have a new force to contend with — TORQUE. This article provides some basic information on this phenomenon.

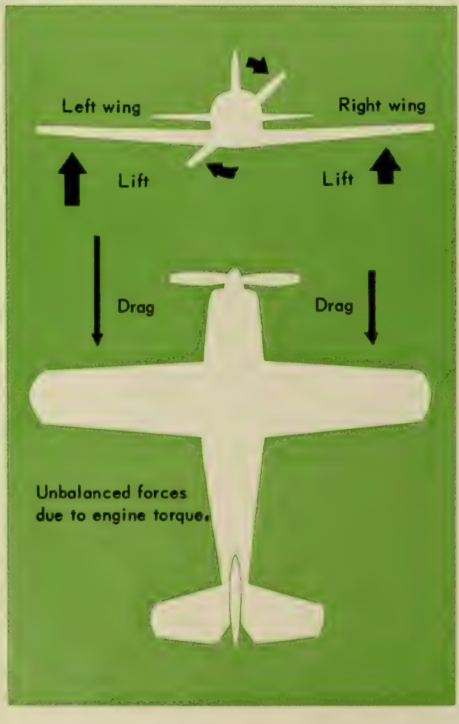
Mention torque and the "P factor"—their cause and effect and how to live with them—and you've got the makings of a lively discussion.

In flight training in *low performance* aircraft it is generally taught that torque and "P factor" are of prime concern. In high performance aircraft which feature wing sweep, advanced design engine mounting and high lift devices, to name some characteristics, torque and "P factor" are of varying concern depending on specific design.

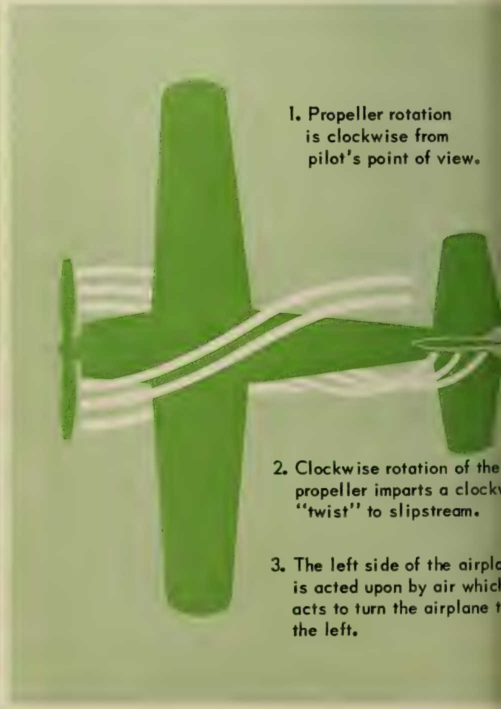
Why do most American manufactured planes have a tendency to turn left on takeoff and climbout? This wayward inclination is sometimes laid to the "P factor" and sometimes to torque, the force which tends to produce a rotating or twisting motion. Both contribute to this aerodynamic phenomenon.

The most significant torque producing force in a propeller driven airplane is created by the rotating propeller. Viewed from the cockpit, propellers in most aircraft built in the United States turn clockwise. The propeller, swinging down to the right, exerts a torque force that tends to rotate the plane to the left.

The way to counteract torque is readily at hand. It is standard



Unbalanced forces due to engine torque.



1. Propeller rotation is clockwise from pilot's point of view.

2. Clockwise rotation of the propeller imparts a clock "twist" to slipstream.

3. The left side of the airpl is acted upon by air whic acts to turn the airplane t the left.

practice for manufacturers to rig the left wing with a slightly higher angle of incidence, creating what is commonly called "wash in." In pusher aircraft and in the rare American plane equipped with a prop spinning counterclockwise, the "wash in" is built into the right wing.

"Wash in" has its limitations since it can compensate for engine generated torque only at a specific power setting and airspeed. To provide maximum benefit to the pilot, wings are rigged for cruising power and airspeed values. At other than cruise, the "washed in" left wing produces more lift, but also causes additional drag. This causes the plane to turn left unless something is done, besides constantly applying right rudder, to counteract this tendency. Setting the leading edge of the vertical stabilizer off to the left a small amount gives the same effect as applying slight right rudder, and is sufficient to cancel out the inclination to turn left at cruising speed.

An easy test for correct rigging can be made in flight at cruising speed using the trim control only. To verify the tendency of the aircraft to turn left, raise the nose with the trim control. If the plane begins to roll and turn left as it loses speed, the rigging is correct because the fixed settings of the wing and vertical fin are insufficient at less than cruising speed to counter the torque produced by the engine.

If the airplane is then nosed down with the trim control only, it will tend to roll and turn to the right as the speed increases because at higher-than-cruising airspeed the fixed settings are more than enough to overcome the engine torque.

Since the rolling effect of torque is greatest at the maximum power settings used for takeoff and climb, it is necessary to use some force on the ailerons to maintain directional control. Application of aileron control, usually to the right, adds drag to the left wing, creating a tendency for the plane to turn left during takeoff and climb.

It is routine instruction procedure to tell students they must hold right rudder on takeoff and climb to compensate for torque. This is not the whole truth—there are other factors which contribute to the left turning propensity of American planes.

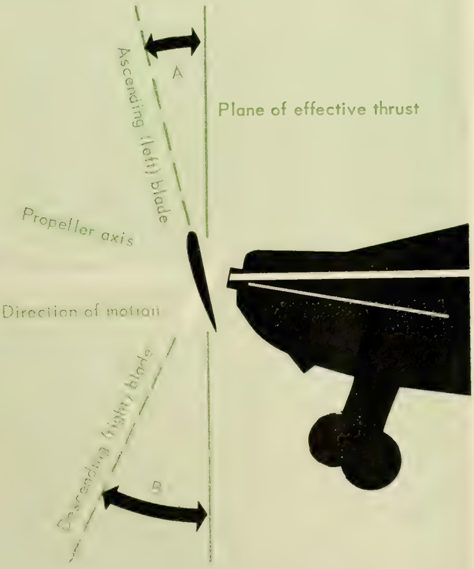
Here's where the "P factor" comes in. This is defined as the asymmetrical thrust delivered by the propeller, especially in single engine aircraft, when the flight attitude is changed. As long as the prop screws its way through the air in a direction absolutely parallel to the shaft on which it is mounted, the thrust is uniform all around its plane of rotation.

If the angle is changed, however, as in a climb or takeoff, the propeller blade as it descends on the right side of the aircraft has a much higher angle of attack than it has on the left, or ascending, side. This greater thrust will turn the plane to the left. The greater the angle of attack, the greater turning effect created by the "P factor." This is a characteristic of tailwheel craft on the takeoff roll and of all aircraft upon liftoff.

The effects of torque and asymmetrical thrust are present in both single- and multi-engine aircraft.

Torque and the "P factor" have fueled many a hangar flying session and will continue to do so as long as men fly. There are *yea* and *nay* sayers but it is the end result that counts—flying safety. Just watch your "Ps" and "Ts"—your "P factor" and your torque. ★

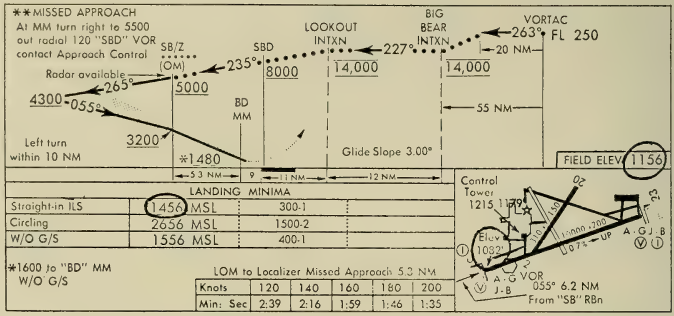
What 'P' Factor Is All About



The effect of unsymmetrical propeller thrust (P factor) on the tailwheel type airplane rolling in three point position, or on any airplane at a high angle of attack. Note that the angle of attack (A) of the left blade is much shallower than that (B) of the right blade, which causes additional thrust on the right side of the propeller disc.

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas



Q. Why do some installations establish ILS minimum altitude based on field elevation and others based on threshold elevation? (See examples.)

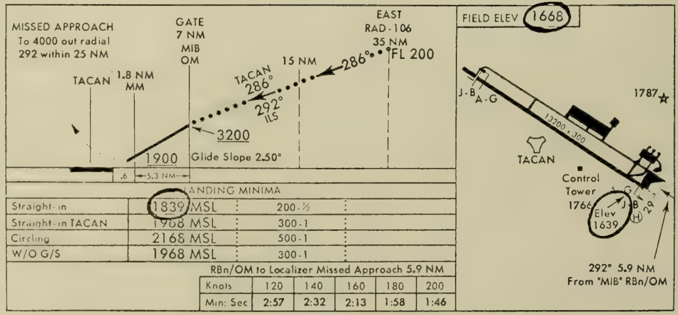
A. Existing directives (JAFM 55-9, AF Form 1368, etc.) do not provide specific guidance on how to establish ILS minimum altitudes. As a result the manner in which a minimum altitude is established varies, based on interpretation. The forthcoming TERPS (New JAFM 55-9) hopefully will solve this problem. Specific guidance is provided.

Q. Where is published field elevation measured?

A. The published field elevation is the elevation of the highest point on the landing area that is used or intended to be used for takeoff and landing.

POINT TO PONDER

Does your base have altimeter check point signs near the end of each runway? AFR 55-48 states, "If the takeoff end of any runway varies more than 10 feet off the official field elevation, a marker will be conspicuously displayed near the end of that runway indicating the exact elevation at that point." If you do not have altimeter check point signs at your base, are you sure it is because the elevation at the end of each runway is less than 10 feet from published field elevation? ★



Missilanea

HAZARDOUS INGENUITY. Safety showers, placed in many environments for the protection of personnel, particularly from the effects of chemical contact, have become a familiar sight to missile maintenance, operations, and support personnel. The reliability of these showers—a must—is verified by daily checks, usually required by tech data. The fact that the shower works, however, is not the only end result to be desired; assurance should be made that the water will not be restricted from contacting an individual under it!

In recent visits to the field, it was noticed that in the best traditions of Yankee ingenuity, plastic sleeves had been attached to the shower head, running down to the drain. Responsible personnel indicated that the sleeves had been affixed to prevent water from spraying the area during the daily check. But at one base, the sleeves presented a problem—they were taped so tightly to the shower head that they could not be readily pulled loose in the event of an emergency.

A thorough check should be made of each emergency shower in your organization. Assure that all showers function properly and that, should the need arise no individual would be impeded or even delayed from using a shower.

Lt Col K. H. Hinchman
Directorate of Aerospace Safety

BENT PROBE. An attempt to service the rear main landing gear struts of a B-52 resulted in an AGM-28 "Hound Dog" missile receiving a bent aerodynamic probe.

An airman, directed to service the struts, obtained an MC1A air compressor and started hand pulling it along the left side of a B-52 with AGM-28s on board. It was windy and the 5-foot long AGM-28 probe cover streamer was blown back and forth. On one of the streamer's swings, it became entangled in a partially open door of the air compressor and before the compressor could be halted by the airman, the probe was bent. To prevent recurrence, all probe cover streamers are being shortened to two feet.

Movement of the missile or of equipment around the missile continues to cause many of the "Hound Dog" mishaps.

Capt R. A. Boese
Directorate of Aerospace Safety

A LESSON TO REMEMBER—A certain Air Force space booster launch complex is located within a few hundred feet of an aircraft parking ramp and taxiway. During the actual propellant flow of a dual propellant loading (DPL) exercise, a transport aircraft started engines and also taxied very close to the launch pad.

An accident did not occur but safety was jeopardized and safety procedures were violated: The DPL and the aircraft flight departure were not effectively coordinated. The pilot did not meet his established takeoff time, the flight operations officer did not enforce the takeoff deadline nor request a hold on the DPL countdown, and the Missile Safety Officer did not delay the propellant flow, although both telephone contact and closed circuit television surveillance existed. Folks were duly embarrassed. You may be sure that additional emphasis was placed on the need to comply with safety procedures.

The point of this story is not that some mistakes were made, but that a valuable lesson can be gleaned from this example. There are times when control of a situation is gradually eroded, then completely lost. When individuals are in the process of working themselves into some sort of corner, there is seldom an early, overpowering warning which is sufficiently forceful to attract just anyone's attention.

Colonel W. R. Sturm
Directorate of Aerospace Safety

Most people, especially those knowledgeable in their field, become concerned sufficiently early that something may be amiss. Nevertheless, an inability to "bite the bullet" sometimes persists until control is lost. Trouble, at its inception, often is not fully and clearly recognized. Usually only a germ of an idea exists which must be developed. The lesson to remember is that, when doubt or concern first appear, safety representatives must have both the resolve and self-discipline to meet the problem with deliberate analysis. They must strive to be deliberate rather than dependent on hope to "muddle through," in thought processes needed to "stay ahead of the airplane." Control of dangerous situations can then be maintained through timely, confident, and decisive action.

Lt Col K. H. Hinchman
Directorate of Aerospace Safety

AEROBITS

JUST AFTER THE T-33 leveled off, the right tiptank fell off and was observed by the pilot to land in a wooded area and burst open. He was able to control the aircraft but decided his best bet was to jettison the left tank also. This he did over water, then returned to the base of takeoff and landed. There was no damage to the aircraft.

The tiptank pin guide lock was loose and it appeared that when the locking pin was inserted, it missed the slot in the release lever forcing the lever to a partially open position. The airstream then may have forced the release lever to the open position releasing the tank.

GEAR SWITCH—During takeoff, the gear of the F-106 appeared to come up normally, then a loud "clunking" sound occurred and the gear unsafe warning appeared. This was followed by secondary hydraulic system failure. The pilot slowed down, lowered the gear by the emergency system and made a safe landing, but the right inner gear door and linkage were lost and the hydraulic line was severed.

This incident was caused the night before when the inner door uplock switch was wired closed in order for the ground crew to check out drop tank operation. The wire was not removed and was missed on both the maintenance and pilot preflights. During retraction, all three gear up switches were closed before the inner door was locked up. With the three switches closed, hydraulic pressure was relieved from the gear up side of the strut and the gear lowered by gravity.

THE VALUE OF good preflight briefing of emergency procedures for nonrated passengers was illustrated in a recent T-33 accident. The aircraft was a low level target for a stan/eval radar intercept. The rear cockpit was occupied by a maintenance officer on his first jet ride. Approximately 12 minutes after takeoff, complete engine failure occurred at approximately 7000 feet.

The pilot turned the aircraft toward an emergency field, but decided it was too far away, considering his altitude and prevailing headwinds. He informed his passenger that they would have to leave the aircraft and rebriefed him on ejection procedures.

Ejection was initiated by the pilot from the front seat. Both ejections were completely successful, the pilot and passenger landing safely with only very minor injuries.

The thorough briefing given the passenger by the pilot prior to takeoff and the opportunity to rebrief him during the emergency was a major contributing factor in his successful escape. This briefing instilled confidence in the system and enabled him to employ proper ejection and parachuting procedures.

A word to the wise is sufficient. You will never know when you may have to instruct your passenger to leave an already unfamiliar environment for a more unfamiliar and even more unfriendly one. Make certain he is afforded the best possible chance of coming through unscathed. The best way to insure this is through a thorough briefing of the escape system.

Robert H. Shannon
Safety Officer, Life Sciences Div

FOLLOWING A JEEP accident, 15 miles from base, the HH-3C crew ferried two doctors to the scene to aid the injured driver. The landing was made on the road near the overturned jeep. When the patient was ready, he was placed aboard the helicopter and takeoff was begun. During hover it became apparent to the pilot that he had insufficient power to clear the obstacles surrounding the confined area. Using good judgment, he elected to hover the aircraft as high as possible, then jettison the external tanks which were still full of fuel.

When all available power was used and the tanks were released, the aircraft climbed out of the clearing and proceeded to the base. After the tanks were released, the crew chief saw an object which looked like the cap and filler neck from the jettisoned right tank fly up toward the rotor and fall back down. No vibrations or control problems were encountered. After the helicopter landed, an inspection revealed a dent in the bottom of the tip section of one rotor blade.

As a result of this experience, a recommendation was submitted to modify the fuel dump system to allow dumping of fuel from the forward internal fuel tank. This would have eliminated the need to punch off the external tanks and also provide more margin for safety.

WHILE TAXIING to the parking area after landing, the student pilot was having trouble opening the canopy of a T-37. The IP took over taxiing and told the student to actuate the internal canopy switch and recycle the canopy locking lever. Still no results.

While the IP was parking the aircraft, the student placed the internal/external switch to the external position. The IP signaled to the crew chief, who was standing on the right side of the aircraft, that the canopy wouldn't open normally. The crew chief started around to the left side to open the canopy but the airman who had just chocked the wheels beat him to it. Noticing the open exterior jettison door, and a signal from the student that he interpreted as instruction to jettison the canopy, he did just that. Actually the signal was meant to indicate the airman should actuate the external canopy open switch.

The problem was a breakdown in communications between the student pilot and the airman, who had been working on the flight line for only two weeks. The reason for the canopy being reluctant to open was overservicing of a strut which prevented the squat switch from closing, and completing the canopy actuating electrical circuit.

FOREIGN OBJECT DAMAGE has been and will continue to be a very serious problem and one that is difficult to lick. Stones and other small objects will get on the pavement and be ingested by the engines. Efficient ramp cleaning helps mitigate this problem, along with sharp-eyed maintenance people who pick up objects they find lying on the ground. But FOD that results from carelessness cannot be tolerated.

Recently a C-124 was on final approach. As the flaps were being lowered the aircraft started to roll to the left and entered an estimated 35 to 40 degree bank. The flaps were retracted and both pilots managed to bring the aircraft to a level attitude by brute force.

After landing the aileron appeared to feel normal, but inspection of the aircraft disclosed sheet metal damage to the forward outboard corner of the right flap. Apparently the damage and the restriction on the aileron was caused by on open end wrench that was later retrieved from the right flap well about 18 inches from the right aileron. Apparently the wrench had been in the flap well for some time and somehow worked itself into contact with the right aileron. It was thought the wrench became dislodged possibly by the slip

AERO BITS

stream or light turbulence on the approach.

A similar event occurred when elevator travel of a T-37 was affected by a ⅜" tubing storage cap which had been left in the aircraft.

There is no way of knowing how many aircraft have been lost to this cause. While many accidents have been documented, frequently the object is lost in the ensuing crash and all we have to show for it is an accident with no determined cause factor.

C-130 ACCIDENT TREND. Since the C-130 entered the USAF inventory in 1955, it has been involved in 40 major flight accidents. Prior to 1965 the maximum number of major accidents occurring in any one year was four. Four were recorded in the years 1958, 1959, 1961, 1962 and 1964. In 1965, nine major flight accidents occurred, eight of which were attributed to pilot factor, and one to facilities. From 1 January 1966 to 31 March 1966, six major accidents were recorded; however, at this time no specific overall trend except pilot factor can be identified.

Due to the C-130 mission, flying-hour increase and shortage of high time C-130 aircrews, the C-130 accident rate may well continue to increase. Statistics indicate that 38 per cent of the total C-130 flight accidents have occurred during the past 15-month period from 1 January 1965 to 31 March 1966.

Major William M. Bailey, Jr.
Directorate of Aerospace Safety

FALLOUT

Continued from inside front cover

The most striking example of enlightened thinking on the part of the author was his statement that piling on more "thou shalt nots" will not solve the problems.

One fact will have to be faced, in some areas of the country, good managers cannot be had at any price. I happen to be in one of these areas and know that the commanders responsible often have a difficult choice: (1) have second best type management, (2) put in his own GI manager (improper according to current regulations) or (3) close the facility. A close look at commands using military managers will show a much better safety and operating record.

I admit that the loss of even one manhour due to an Aero Club mishap is too much but other types of motor vehicles kill and maim far more people than do aircraft, yet few threats are heard to eliminate motorcycles, boats or cars. The National Safety Council reports more boating deaths annually than all of the light plane accidents in the United States.

I believe that the Air Force is the most likely place in the world to find people who want to fly. Therefore Aero Clubs are likely to always exist in one form or another. If they exist on the base, the commander should exercise a measure of control. If they are closed, as is sometimes threatened in order to "solve" the problems, watch for the "spontaneous" clubs to start at the local civilian airport. They will not have the assistance present USAF clubs have, thus will not operate as good equipment. Compound poor equipment with no supervision from the friendly Ops and Safety people and the loss of life and manhours due to accidents will not decline but will probably increase.

There is established in Hq USAF an office staffed with good people to oversee the program. The next step is approving military managers reporting directly to the base commanders where they are not otherwise available.

TSgt Reginald E. Holden
1513 Vallotton Drive
Valdosta, Ga. 31603

BIG "S" FOR AERO CLUB

The Hickam Aero Club enjoys the sometime reputation of being the largest in the USAF. We say "sometime" because of the unplanned losses of major segments of club membership to other than normal rotations of sponsors.

All of us who have any responsibility for the club are intimately acquainted with AFR 215-2, AFM 215-4 and instructional letters from Randolph. These are all contained in "required reading," either PIF, SOPs or otherwise. But we needed somehow to summarize our formula for a successful operation.

After a bit of tidal action in several craniums, we evolved the expression: Safety, Supervision, Solvency, Success: "Big S for Aero Clubs."

SAFETY
SUPERVISION
SOLVENCY
SUCCESS

BIG S FOR AERO CLUBS

The Hickam Club has just completed a 9500-hour annual flying program with its all-Cessna fleet. One reportable incident occurred. We have full-time management, mechanic and dispatchers who share a very attractive incentive bonus (30 per cent of net operating profit) beyond adequate salaries. Our majors and annuals are performed by an FAA approved commercial maintenance facility. Flying hour charges and instruction fees are flat rates, wet, and all fees are paid to the club. Our flight and ground schools are FAA certified and our Chief Instructor Pilot is a designated FAA Flight Examiner.

Our club is good, our equipment is good and so is our safety record. We invite transiting club members to fly with us.

Col F. N. Thompson
PACAF, Hickam AFB, Hawaii

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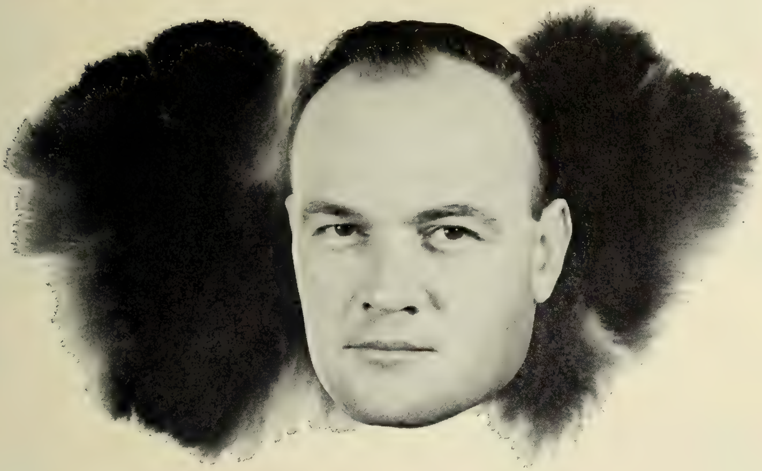
✸ WELL DONE



CAPTAIN FRANKLIN A. CARAS

4758 DEFENSE SYSTEMS EVALUATION SQUADRON, BIGGS AFB, TEXAS

Captain Franklin A. Caras was flying number two position in a flight of two F-100Cs, that had departed Biggs AFB on a local instrument training mission. During the climb, it became apparent to the leader that instrument conditions would be encountered, so he signaled Captain Caras to join in close formation prior to penetrating the clouds. As Captain Caras rolled into a left turn, the rudder pedal froze in the deflected position. Captain Caras alternately applied right and left rudder in an attempt to free the pedals. Each time left rudder was applied the pedal would deflect a little more in that direction. This resulted in the rudder being deflected to almost a full left position. Squadron operations was notified of the malfunction, and due to the adverse crosswind at Biggs, both aircraft were diverted to Cannon AFB. Enroute to Cannon AFB, the pilot was occasionally able to break the rudder free, only to have it freeze in some other intermediate position. At the time of landing the rudder was frozen in approximately the neutural position, so the pilot elected to attempt a landing from a straight in approach. While the wind was more aligned with the runway at Cannon, its velocity was about 30 knots. This would require either rudder control or nose wheel steering after touchdown to keep the aircraft on the runway. Captain Caras flew a long straight-in approach and touched down with the rudder locked. When the nose wheel was placed on the runway in an attempt to acquire steering, the rudder broke free, and a normal roll out accomplished.

Investigation revealed a one-quarter inch castillated nut lying against the rudder actuator assembly. Analysis indicated it had locked the rudder. Captain Caras' cool and disciplined handling of this emergency prevented the loss of a USAF aircraft. WELL DONE!

For Meritorious Achievement in Flight Safety for the period 1 January through 31 December 1965, the units listed here have been selected to receive the Air Force Flying Safety Plaque. The stringent criteria insure that each recipient has achieved an outstanding flying safety record while maintaining mission capability.

Flight Safety Awards

AAC	• 317 Fighter Interceptor Squadron, Elmendorf AFB, Alaska
	• 5017 Operations Squadron, Elmendorf AFB, Alaska
ADC	• 1 Fighter Wing, Selfridge AFB, Michigan
	• 57 Fighter Interceptor Squadron, Keflavik Airport, Iceland
AFSC	• Air Proving Ground Center, Eglin AFB, Florida
ATC	• 3510 Flying Training Wing, Randolph AFB, Texas
MAC	• 63 Military Airlift Wing, Hunter AFB, Georgia
	• 61 Military Airlift Wing, Hickam AFB, Hawaii
PACAF	• 416 Tactical Fighter Squadron, Tan Son Nhut AB, Vietnam
	• 45 Tactical Reconnaissance Squadron, Misawa AB, Japan
	• 6441 Tactical Fighter Wing, Yokota AB, Japan
	• 21 Troop Carrier Squadron, Naha AB, Okinawa
SAC	• 7 Bombardment Wing, Carswell AFB, Texas
	• 454 Bombardment Wing, Columbus AFB, Mississippi
TAC	• 363 Tactical Reconnaissance Wing, Shaw AFB, South Carolina
	• 481 Tactical Fighter Squadron, Cannon AFB, New Mexico
	• 516 Troop Carrier Wing, Dyess AFB, Texas
	• 4510 Combat Crew Training Wing, Luke AFB, Arizona
USAFE	• 20 Tactical Fighter Wing, RAF Wethersfield, England
	• 49 Tactical Fighter Wing, Spangdahlem AB, Germany
ANG	• 133 Military Airlift Group, Minneapolis-St. Paul Intl Airport, Minnesota
	• 141 Fighter Group, Spokane Intl Airport, Washington
AFRES	• 349 Troop Carrier Wing, Hamilton AFB, California
	• 434 Troop Carrier Wing, Bakalar AFB, Indiana

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AEROSPACE
SAFETY
UNITED STATES AIR FORCE

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JULY 1966

PUSH LATCH TO OPEN DOOR

THE LAST DECISION

see page twenty-two

AEROSPACE
SAFETY

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AFRP 62-1 JULY 1966 VOLUME 22 NUMBER 7

FALLOUT

LANDING TECHNIQUES

I've read the article "Never Excelled" (April issue) and thought you might be interested to know that with the completion of the 389th Tactical Fighter Squadron's rotation to Alaska, the 366th Tac Ftr Wing was relieved of its northern obligations and PCS'd by squadrons to Southeast Asia. The 389th is now back to the air-to-ground business in the Republic of Vietnam.

Curiously enough, the landing techniques developed in Alaska have proved particularly beneficial in a climate that is directly opposite in nature. A thoroughly rain soaked aluminum plank runway has been proven to contain the same characteristics as an icy runway with the exception that it is less than half as wide. As a result, it did not take much prompting to continue with the "crunch—trust your antiskid" type of landing that keeps you and the F-4C out of serious difficulties when the RCR hovers around 12 or less.

Lt Col Felix C. Fowler, USAF

MISSILANEA

May I direct your attention to the photo on page 25 of the May issue? I believe that old Atlas F (HGM 16-F) crewmembers and maintenance personnel will feel a bit of nostalgia as they recognize a silo-to-LCC shot of the Utility Tunnel through which we passed many times. "Minutemen" may not recognize their "implied" home.

With the absence of the third blast door (a late program modification) and the presence of the "silo controller" at the top of the steps, this picture may have been taken during the I & C phase of the Atlas program (1961-1962).

Along with this "nostalgic" observation, may I add praise for all your efforts and very fine magazine? For over three years of the "underground duty," your publication was a source of contact with the rest of the Air Force.

Here's to continued success.

Capt Raymond W. Danielson, Jr
46 Air Def Msl Sq (BOMARC) (ADC)
McGuire AFB, New Jersey 08641

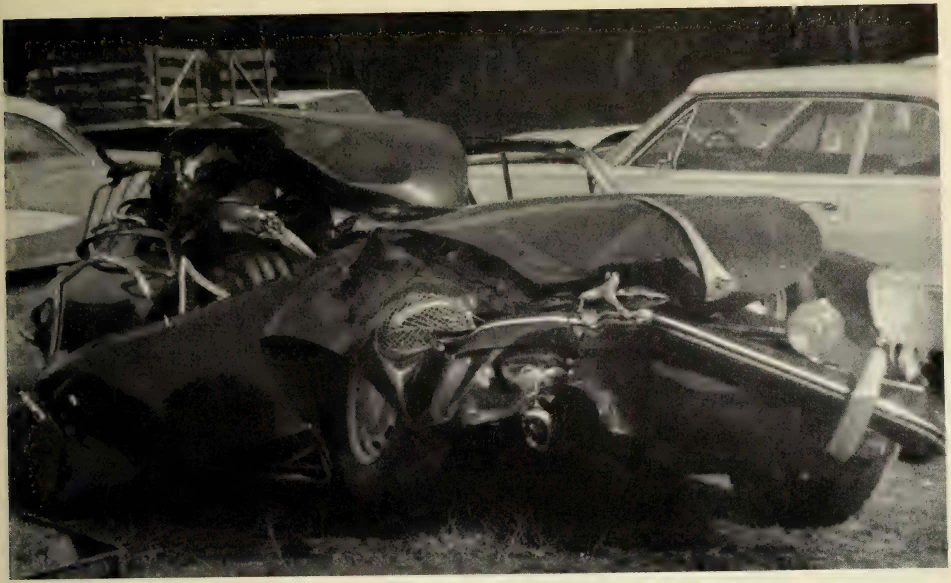
Thanks for writing. Just proves that you can bury a man in a hole underground but you can't keep his mind out of the sky. As for the photo, the artists plead "artistic license." Guess this is what they call a mood pic, not intended to portray a specific situation.

TOP BUTTON

After reading your article "Fasten That Top Button" (May issue), I must admit that I required several minutes to calm down, but I believe the pilots who are still flying the fighters (and damn proud of it) deserve their say.

I think what I noted first was the author's decided lack of "professionalism" as a fighter pilot (kick the tires, etc) went out a long time ago and if that was the author's idea of being a fighter pilot, then all my associates are glad the recip troops are stuck with him.

continued on page 28



Gamble of Life

Capt Guy K. Buesing, 509 Bomb Wing, Pease AFB, N. H.

Most of us have been subjected to safety lectures well larded with statistics. The figures tell of the number killed in automobile accidents, show that most accidents occur within a 25 mile radius of home, and prove that safety belts save lives.

This is not another lecture based on statistics. Instead it is the story that goes with the picture above. Look at the condition of the car. Is it possible that the driver could remain alive? And if he survived, it would seem obvious that he would be a permanent invalid destined to dependence on others.

I was in that car. I am alive without any disability whatsoever. I have full coordination and mental alertness. Granted, there was a period during which I was in critical condition, but recovery was swift and complete. This quick recovery I attribute to my general good health. But that I recovered at all can be attributed to something else: The attending physicians, as well as the New Jersey state policeman involved, have stated that the only thing that saved my life was the fact that I was wearing the seat belt-shoulder harness combination.

My most serious injuries resulted not from the impact, but from shock as a result of blood loss after I got out of the car unaided. It is hard to believe that I got out of the car alone, but that I did is supported by the police and medical reports.

Most people consider themselves safe, conscientious drivers who would never get into an accident like this. People who know me personally classify my driving habits as safe. I have been driving for more than 10 years and using seat belts for the last eight. These belts were used on base and off base, whether traveling a few blocks or several miles. Finally an accident occurred where the belts unquestionably proved their worth.

Many people refuse to wear seat belts. Their rationale is that a friend or relative lived because he was not wearing a belt, or they know of a person who died because he happened to be wearing a seat belt. Some of us don't use seat belts because of the inconvenience and the few seconds necessary to fasten them. This article has been written mainly for all of these people.

Police and medical reports state that fatigue, drinking, speeding, and careless driving were not factors in my accident. Without going into details, this collision with a tractor-trailer was not my fault, but it happened. Why? Call it the law of averages, fate, or just "one of those things." Regardless, even the safe, conscientious driver is subject to accidents.

In many ways life is a gamble. No one can accurately predict the future, but perhaps one can shape it by playing the so-called odds in his favor as much as possible. Driving can also be classified a gamble. One of the odds on your side is wearing seat belts all the time. ★

The temperature was —45° F, his signal devices didn't seem to work and he had a broken shoulderblade. But knowledge, courage and self-control are powerful weapons, and they brought this pilot through his . . .

ARCTIC ORDEAL

On 10 March Captain Roy MacDonald was the pilot of an F-106 that collided with a T-33. The T-Bird landed safely with four feet of the right wing missing but the F-106 was not controllable and Captain MacDonald ejected. This is his story of the 51 hours he spent in the frozen wasteland of central Alaska before he was rescued by helicopter. His experience and excellent recall of the events of those 51 hours provide valuable lessons in survival and rescue. The story is essentially as Captain MacDonald told it with some editing to provide continuity and to avoid redundancy. Editor's comments are in italics.

The aircraft was inverted in a 30-40 degree nose down attitude. Just as I pulled the ejection handles the airspeed was .95 mach and the altitude was between 25 and 30 thousand feet. The right handle was no trouble — got it the first try. Evidently I was on the right side of the seat, as I had to make two or three attempts to get the left handle. I don't remember any specific sequence in the ejection system, such as the canopy leaving, the seat firing, and the man/seat separator working. The next thing I remember I was out of the seat in a face upward position and spinning quite rapidly. I attempted to stop the spinning by putting out my arms and legs and this stopped the spin quite well. But when I tried to turn over on my stomach I would get back into a spin, so I left my arms and legs out and held that position in a free fall.

I don't remember any especially hard opening shock of the parachute — I let it open by itself. After the chute opened and I looked up I saw there was one rip in the canopy, and I realized I had lost my helmet, although my chin strap had been fastened. *(The knob had come off the visor earlier and MacDonald put it in his pocket. He said the visor, being loose, came down and protected his eyes. He felt that if the knob had been in place he would not have had time to lower the visor.)* After checking the canopy, I attempted to cut the marked lines with the knife that was attached to the right side of the right risers. I did get the two right lines cut but could not cut the left ones because of an injury to my left shoulder. *(His left shoulder blade was broken, apparently from the opening shock.)* I then deployed the survival kit and started checking my wind drift along the ground as best I could. The wind appeared to be blowing hard as I was drifting quite fast.

As I neared the ground, I pulled the quick release cover and just prior to hitting the ground, I put my fingers in the quick release rings and assumed the landing attitude or position. When my feet touched the snow I jettisoned the çanopy. Clean separation — no problem of being blown by the wind. I did not specifically notice any oscillation during the letdown. It appeared to be quite stable, and I did not notice any rotation. This was demonstrated at Life Support School. During the drop in the parachute, I was surprised that I wasn't cold—no sensation of being cold. I landed in about three feet of snow and there was no big landing shock — quite a smooth landing.

Immediately after landing and after trying to calm down and get my senses together, I started looking for a place to make a camp. I think the first thing I did was take off my summer flying gloves and put on my winter gloves and put up the hood on my flying suit. I had landed just off the top of the ridge on the downwind side. Approximately 75 yards down the ridge there were quite a number of trees, both evergreens and dead timber. I thought this was the area to make my camp and started down, pulling the life raft and survival kit with me.

After getting down to the area and looking it over, I decided it would be suitable for my camp and then decided I should get the parachute out in case rescue aircraft flew over. Prior to starting back up the ridge to my parachute, I took two day/night flares out of my survival kit and put them in my flying jacket pocket. I then climbed back up on top of the ridge, spread the parachute out and tied it to low bushes. While I was putting the chute out, two F-106s flew directly overhead. I set off one of the Mark 13 smoke flares but then realized that the 106s were moving too fast and would not see the smoke. I cut off part of the parachute to use as a shelter and for any other items I might need, and started back down off the ridge to my camp. I left a total of four panels on the ridge, two orange and two white, for signaling devices.

BUILDS SHELTER

The snow depth in the area varied from three or four inches on top of the ridge to several feet in my camp area. At times I could walk on top of the snow and at other times I would sink up to my knees when going from the top of the ridge down to my camp. I made an A-frame type shelter by tying nylon parachute cord between two trees and putting the parachute over this cord and tying it down to other trees. Prior to making my shelter I had walked on the snow and tramped it down as much as possible. After I had put my shelter up, I took one of the saws out of the survival kit and cut the snow deeper inside the shelter and tried to make the floor as smooth as possible. I inflated both LPUs and put them inside the life raft, snapped the cover and turned it upside down to use as a mattress or to keep me off the snow. I then took all of the padding that I could get, such as the cushion on the back of the parachute and the seat cushion on top of the survival kit and put these on top of the raft to insulate me against the raft.

During this time I could hear search aircraft in the area and I was using both the SARAH radio and the URT-21 radio. I immediately found out that the battery in the SARAH was weak. I could hear the tone in the battery after I turned it on and it would last four to five minutes before dying off. I would then turn the SARAH off, wait a few minutes, and try it again. The battery would last four to five minutes each time I tried. I had trouble with the antenna on the URT-21. The top two sections of the antenna separated from the bottom three sections and there was a problem in getting the antenna out. Also, I noticed that the plastic plug on the URT-21, which is supposed to automatically turn on the radio on bailout, had not pulled and the radio had not been turned on. I pulled the plug out and was hoping the radio was working. I wasn't 100 per cent sure whether I was supposed to hear a tone in the radio, but I assumed that the set was working. *(He kept the radios as warm as possible by placing them under his flying suit, in the sleeping bag at night, or by the fire.)*

The remaining time before dark I spent mainly trying to get the camp set up, getting dead wood, and trying to find a place to build a fire where it wouldn't sink completely out of sight in the snow. The snow in the camp area was deep enough that I would sink down to my knees, and in some places, clear down to my armpits. Getting wood started to be a problem after a while because I got every thing that was easily accessible; then I had to start foraging

SURVIVAL CAMP—This is where Capt MacDonald spent 51 hours awaiting rescue after bailing out of damaged F-106. Despite deep snow and extreme cold, he survived in good shape.

to the deeper areas of snow. In trying to find a place to build a fire in snow country, it had always been my experience to use green logs as a base on the snow. The green trees weren't too big in this area, and I didn't feel like taking the time to cut them down, so I used the top portion of my survival kit and built a fire on it. This part of the kit lasted pretty much throughout the evening before it eventually burned up.

GETTING ORGANIZED

During that first evening I separated my equipment into several different groups so I could find any item I wanted in a minimum of time. I put all of my flares, radios, signal mirror, strobe light and flashlight in one group, food in a plastic bag in another group, clothing in one group, and miscellaneous items I left in the kit. For my first meal I had bouillon by using one of the bouillon cubes in the survival kit. Drinking this bouillon really pepped me up and helped me get going again. I had felt a little letdown after seeing airplanes in the area but none of them coming too close

For sleeping I used the walk-around sleeping bag and it was quite adequate. I did get a little cold at times throughout the night, but I got several hours of sleep. When I got cold, I would get up and walk around or start a fire and make some tea, or even drink warm water with a little sugar in it. I was quite concerned, of course, about what had happened to the people in the T-Bird and about my family at home. However, I did get several hours of sleep.

On the second day I got up quite early and started to build signal fires. I built two fires, one about 20-30 yards up the ridge from my camp, and I was using my cooking fire. I was wondering about the value of these signal fires though, as I had already experimented with the green boughs and found that the smoke was quite white in color and blended with the snow. For breakfast the second morning I had part of the candy ration, which is included in the kit, and hot tea.

Throughout the day there were many aircraft in the area. The helicopters came to within a quarter to half a mile of my position several times but they were searching down in the canyon, while I was quite far up the slope. I would see the blades of the choppers flashing through the trees below me but they were just too low. Also, several C-130s or C-54s came fairly close, but they didn't spot me. During the second day I used up the remainder of my smoke flares. I used the signal mirror and, of course, the SARAH and URT-21 radios. The battery on the SARAH radio finally gave out on the second day. I had turned it on and the tone in the battery would last from a minute to a minute and a half and then quit. I wasn't too certain that the URT-21 was working, because of the antenna problem and the fact that many aircraft had been in the area when I had the radio on, but apparently didn't hear it. I also looked for cabins or any other buildings in the area by climbing back up on top of the ridge but all I could see was snow and several frozen rivers.

WRECKAGE SPOTTED

In the afternoon, a commercial aircraft flew quite close to my position and I shot off a pengun flare, but apparently he didn't see it as he flew on by. *(The pilot of this light plane located the wreckage of the F-106 about seven miles from where Captain MacDonald landed.)* I also saw a helicopter working across the river to the north and saw him eventually drop a smoke bomb. I thought possibly he had at least located the immediate area where I was; however, later, after I was rescued, I found that he was marking the spot for a fuel drop by the C-130. During all of this time I was using my radios, mirror, flares, and I even lit a signal fire, but it didn't do any good.

During the second day I cut down several green trees and made a fire base out of these. I built my fire on top of the green boughs, but eventually even they caught on fire and I finally had a hole about four feet deep directly in front of my tent, so I then used the bottom portion of my survival kit to build a fire in. Gathering wood for the camp was getting to be a bigger problem, as I had already burned all the dead wood in my immediate camp area. I was not especially hungry during the second day, but drank a great quantity of liquid. I would melt snow and either drink just the water or tea or coffee. Again for supper the second night I had hot bouillon.

To try and sleep a little more comfortably the second night, I climbed back to the top of the ridge, took my parachute signal down, and made a sleeping bag with it. This helped a little and I was a little warmer the second night. One of the things that bothered me after a while during the second night was that I would just get to sleep when a rescue aircraft would fly in the area. I didn't know if it was coming into my immediate area or not, but I would get up out of bed and take all of my signaling devices back out into the open to wait and see if the aircraft would fly over or near me. Sure enough, the aircraft would fly in the other direction. It happened several times during the second night and I began to wish that they would just go away and leave me alone until morning. One aircraft, in particular, on the second night flew quite close. I fired a pengun flare and also had my strobe light on and hanging about two feet above the snow on a small tree. This made a very bright flashing light, but the aircraft did not see it. On both the first and the second nights I had both radios in bed with me, trying to keep them warm.

RESCUE NEAR

On the morning of the third day I was up early, as there was already a great deal of activity in the area. I took my parachute signal back to the top of the ridge, spread it out and tied it down. This was when I first noticed that I was losing strength and didn't have as much energy as I had the first two days. It took longer to climb through the snow to the top of the ridge, and I had to stop and rest more often. Throughout the day I tried to keep busy by collecting wood and green boughs or just by doing minor things around my camp. If I got cold all I had to do was walk a little or saw a little wood and I was quite warm.

Again, on the third day, I drank a lot of liquid. There were aircraft all around the area and I was trying to use all of the signal devices I had. Finally, in the afternoon, I saw a C-123 headed in my direction, and I turned on the URT-21 and also used the signal mirror. As the aircraft approached my position, I fired a pengun flare but the aircraft kept on going. He then made a 180-degree-turn and came back in my direction and I fired another flare, but again the aircraft flew right on. I thought that he was leaving the area, as he flew quite some distance this time, but he finally made another 180-degree turn and came back. I set off one of my signal fires and one of the night ends of the Mark 13 flares, and shortly I heard the helicopters coming my way. It was then just a matter of minutes before the choppers landed and I was picked up and taken back to Galena.

* *

In addition to his statement, Captain MacDonald answered a number of specific questions, and other items of interest were brought out during the accident investigation. These are summarized here:

Captain MacDonald ejected at about 1245. The aircraft IFF squawked automatically, was read by a GCI controller for about 20 seconds and was used to mark the area. However, it was 28 hours before the F-106 wreckage was found and 51 hours before he was located and picked up by the chopper.

Intermittent signals were received from the SARAH during the first two days but the URT-21, which eventually led to the rescue, was heard on the third day only. Electronics specialists say that, with the URT-21 and SARAH transmitting simultaneously, the SARAH receiver would be affected by the URT transmission, but that the direction finding function of the URT-21 would not be impaired. The SARAH later was found to have a weak battery (dated March 1962) and bent pin in the antenna canon plug. The cord from the parachute to the URT-21 was not prop erly fastened which precluded automatic operation of the URT-21. Captain MacDonald had trouble extending the antenna and it came apart. He did not remove the flex antenna as directed in the instructions.

Other signal equipment: Captain MacDonald had three day/night flares, a pengun and seven flares, a signal mirror, strobe light and a .38 revolver with tracer ammunition. All the flares except one pengun flare worked, but he had some difficulty with the day/night flares in that the metal ends broke off. Although the strobe light was used both nights, it was never seen by searchers. Nor did they see flashes from the signal mirror. MacDonald didn't use the tracer ammunition, figuring that if the other devices weren't seen, it would be futile to use the tracers.

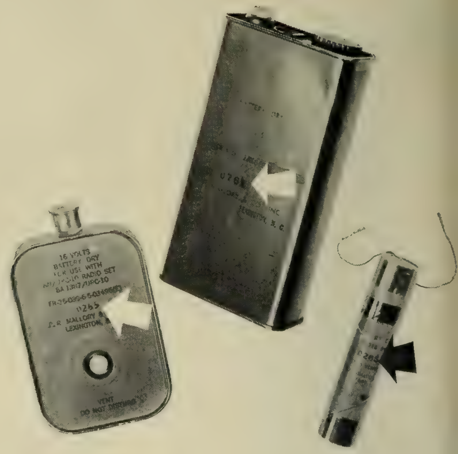
Survival training: Captain MacDonald had no formal arctic survival training, although he had some briefings. He attributed his ability to cope with the situation to his camping and hunting experience as a boy in Idaho.

Survival equipment: The standard seat kit was considered good but lacking in some items. The two bouillon cubes were missing from one of the two plastic packets and there was no weapon (.410-.22 shotgun-rifle combination). MacDonald had an ADC minimum survival kit in his flying suit leg pocket, but the pocket came open during the ejection and the kit was lost. The walk-around sleeping bag he considered excellent, but he recommended the kit contain more bouillon cubes and possibly some dry soup mixes. He used the candy bar container for water and for melting snow. An additional item, he suggested, is a piece of metal in the kit upon which to build a fire in deep snow.

Clothing: Although the temperature hovered around −45°F., MacDonald was comfortable most of the time. He was wearing ordinary underwear under thermal underwear, a winter flying suit, winter jacket, light cotton socks, insulated socks and mukluks. He had bunny boots, although the valves were missing. As long as he moved about his feet did not get cold. He had extra socks and he changed from time to time to keep his feet dry. The wool hood over his face plus the winter flying suit hood provided good protection from the wind even though ice formed on the wool hood around his nose and mouth.

The man: Undoubtedly the most important factor in his survival was Captain MacDonald himself. He exhibited unusual ability and excellent control of himself as demonstrated by his first two thoughts after landing. His first was that he must keep warm, and his second was that he must remain calm and conserve his energy. ★

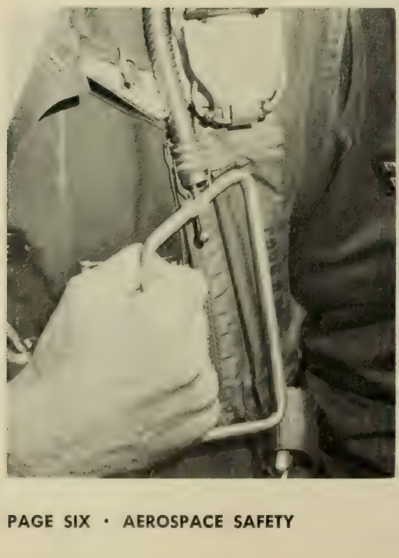
Personal Equipment Notes

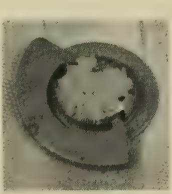


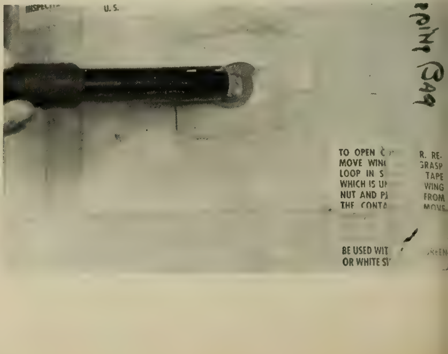
The photos at right of batteries taken from survival radios carry a message. Unfortunately, there are some who don't know how to read that message. The numbers pointed out by the arrows indicate the expiration date; for example 0265 means February 1965. SEG recommends shelf life not to exceed two years.

The photo below shows a D-ring that was discovered safety wired. According to the folks who sent us this picture, this chute could not have been successfully deployed. Apparently this is not a one-time incident; others have been shipped with the safety wire installed.

In the April issue of AEROSPACE SAFETY there was a short item on the problem of opening some survival sleeping bag containers. A1C Lewis Smith, 840 Supply Squadron (TAC) at Lockbourne AFB, has an answer to this. SAC MD-1 kits contain the SRU-16/P combination digging tool. A slot on the end of the handle is just the thing to turn a reluctant wing nut on the container. Caution: unfasten the wing nut before removing the container binding tape — the tape relieves some pressure on the bolt.







DIG, DISTILL & SURVIVE ★ ★ ★ ★

Adapted from a paper "Water for Survival" by R. D. Jackson and C. H. M. van Bavel, Research Physicists, U. S. Water Conservation Laboratory, U.S. Dept. of Agriculture, Tempe, Arizona.

Survival experts say that to live in the desert in summer a person needs about a gallon of water a day. The amount varies with one's activity.

Where is one to get this water? To the casual visitor the desert looks inhospitable in the extreme; to the survivor the desert no doubt seems downright hostile, and the availability of water nil.

Well, there is water and it can be obtained by a method known as a survival still, which distills water from the soil or other water-bearing material. The only tools needed are a sheet of plastic film, sunlight, and a container.

Construction is simple: dig a hole in the ground about 40 inches wide and 20 inches deep. If you leaped from an aircraft you are not likely to have a shovel with you. No sweat — use a stick or flat rock (if there's one thing the desert has in abundance it is flat rocks).

Now place your container at the bottom of the hole. The container can be anything that will hold water. If it is flexible (foil or plastic) shape the bottom of the hole to support the container.

Install the plastic sheet (see diagram) and secure with rocks or soil. Place a rock at the center of the plastic so that the center of the sheet is about 15 inches below the surface. A wettable plastic sheet is preferable (water drops cling to the plastic). One such product is DuPont *Tedlar*, Nr 100 BG-30.

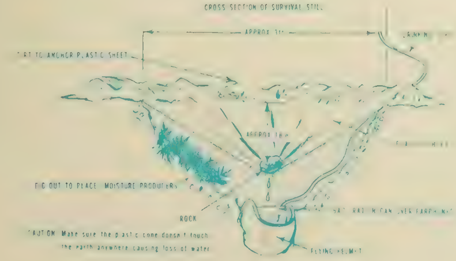
If there are fleshy plants available, such as prickly pear or barrel cactus, pieces can be placed in a trough dug into the side of the hole Or polluted water from a brackish pool, or even urine, can be used to wet the sides. This may be necessary if the ground is excessively dry.

As sunlight passes through the plastic, heat is absorbed by the soil and plant material, or other wetting agent, and evaporation takes place. This forms on the plastic and runs into the container.

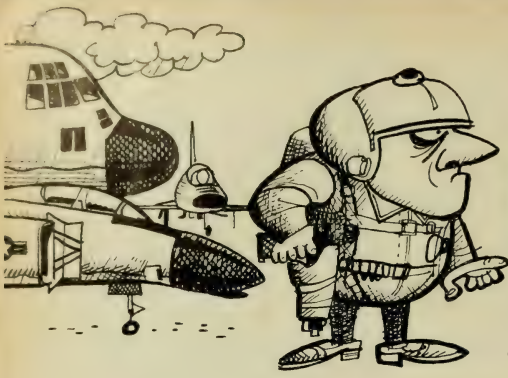
If the soil is very dry — such as loose sand — don't expect much, perhaps one-half pint a day or less. Denser soil that contains some moisture or damp clay, for example, may produce four or five times as much. Of course, you could set up several stills with sufficient material. Since the plastic film is light and requires little space, flight crews might carry the plastic and a piece of foil for a container in a pocket or personal survival kit just to be sure it is handy.

The person using this method of obtaining water must be patient. The air under the plastic will become saturated in about an hour. But the process is slow and several hours will pass before there is much water in the container. Don't disturb the apparatus to get at the water any more than absolutely necessary. In this regard, a piece of plastic hose is a luxury. Run it down the side the hole from surface to container. Then you can draw water out without disturbing the still. ★

CROSS SECTION OF SURVIVAL STILL


APPROX 3'
DIRT TO ANCHOR PLASTIC SHEET
APPROX 18"
DIG OUT TO PLACE MOISTURE PRODUCERS
ROCK
FLYING HELMET

CAUTION: Make sure the plastic cone doesn't touch the earth anywhere causing loss of water



BIRD WAR

For thousands of years man looked into the sky and envied the birds. He decided he had to fly; finally he did. And he learned well. Soon he was flying higher than the eagle, faster than the hawk and could hover in place as well as the hummingbird. But one thing he failed to take into account was that he would be competing with the birds for the airspace.

This wasn't too serious at first — the birds were every bit as fast as the airplanes and a lot more maneuverable. They probably considered man and his flying machines a nuisance they had to put up with.

Then came the jet and the birds had a problem. Man also discovered the problem and the war was on. So far, man has been winning most of the battles but the birds have been winning the war.

We are all familiar with the more lethal encounters between aircraft and birds: The Electra that crashed at Boston in 1960 after striking a flock of starlings on takeoff: the disaster at Ellicott City, Md., in 1962, when a Viscount received severe structural damage in a collision with a whistling swan and crashed killing 17; the death of astronaut Theodore Freeman after a snow goose went through the canopy.

While such disasters are infrequent, strikes occur daily and the cost is tremendous. Last year, 839 birdstrikes were reported by the Air Force. (The large number was the result of special reporting for 1965 only, in which all strikes were required to be reported so the Air Force could get a better idea of the magnitude of the problem.) During the first two months of this year, Air Training Command reported 26 bird strikes, nine of which resulted in damage.

The Air Force is not alone in suffering damage from bird strikes. In a paper on bird control, Roger G. Flynn of the Air Transport Association of America stated: ". . . in 1964 our 43 member airlines reported 413 strikes. In only 156 instances was damage incurred. We estimate the repairs necessary for these incidents cost in excess of $1,500,000 that year."

An FAA advisory circular, Bird Hazards to Aviation, contains this statement: "At the Congress on Bird Hazards at Airports, Nov. 25-27, 1963, a BOAC representative reported that 'in 4½ years, Comet IV (aircraft) required 178 engine changes (due to bird ingestion) costing 2,500 to 15,000 Pounds Sterling ($7,000 to $42,000) each.' A single bird strike caused total loss of one DC-8 engine with a total expense of $140,000, including dumped fuel. . . ."

The problem is international in scope and is being attacked by many countries. It is apparent that not all birds can be eliminated nor would such a course be desirable. Therefore, efforts have been concentrated on (1) making aircraft more bird proof, and (2) eliminating concentrations of birds around airfields.

So far it has not been feasible to do much about aircraft, other than provide bird-proof windshields. The greatest hazard has been to jets, because of their greater speed and there is no bird shredder whirling around in front of the engine. Consequently, sterilization of the areas around airfields appears to have most promise, and, in fact, this is the area of greatest potential hazard. But this is not simple. After several years of research there is still much to be learned about birds habits.

Air Training Command has accepted a new helmet visor that gives aircrews better protection against bird strikes. Designed to protect the pilot's eyes from flying plastic or glass and high velocity air, it consists of two visors, one clear and the other dark. The clear visor is worn down at all times, the dark one as light conditions dictate.

The FAA and Department of Interior have been the principal agencies in the United States investigating methods of reducing the bird strike problem, and they have been sharing data with agencies in Canada, England, Holland, France and other countries. From their studies a number of actions have evolved that have been partially successful in alleviating the bird strike problem. The Fish and Wildlife Service recommends:

For Temporary Relief:

- Flush birds prior to takeoff and landing.
- Require control tower operators to advise arriving and departing aircraft when an unusual influx of birds has been reported on the airfield.

Permanent Control:

- Eliminate dumps and other unsanitary conditions. These attract gulls, starlings and other birds that eat waste food.
- Destroy potential roosting sites. Tall reeds, weeds, or brush attract many birds, primarily starlings and blackbirds.

- Berry and seed producing shrubs should be replaced by shrubs less attractive to bird feeding habits.
- Ponds and other accumulations of water should be drained.
- Keep grass cut near runways and in adjacent areas to control insects.
- Apply herbicides and weed killers to eliminate broadleaf seed plants and weeds.

Listing these methods is a great deal simpler than accomplishing them. For example, flushing birds is not as simple as it may seem. One method that seemed effective was the use of cracker shells, fired from a shotgun device. They make a loud noise and do the trick – for a while. But birds are adaptable and learn to ignore the noise when they discover it is not a threat. Taped distress calls are effective to some degree. But it is the same story: birds get used to the calls and become quite blasé.

As might be expected, gulls are the biggest problem and appear to be the most difficult to eradicate. For one thing, there are several different species, and distress calls for one apparently don't work for another species. And it is extremely difficult at airfields near the coasts to make the environment unattractive to them.

Elimination of feeding and roosting sites is effective but not easy. Sometimes this requires cooperation with nearby property owners and civil authorities. And a one-time mowing of the areas near the runways won't do the job. You have to stay with it; it is a year-around-effort in some places.

A number of methods for making airfields unattractive to birds are presently being tested. One of these is the use of poison. A product that appears to have promise is Avitrol 200, produced by the Phillips Petroleum Co. This chemical causes death to birds after a period of distress in which the affected bird's squawking and strange actions alert his friends who take off for safer hunting grounds. The product has been used at some civil airports and is being tested by MAC.

Bio-acoustics (use of bird communication sounds) is one of the newer methods being researched. This has promise, but bird communication sounds are specific to a species so a great deal of work remains to be done.

Larger birds are, of course, more dangerous. Attempts are being made to use radar to detect flocks of ducks, geese and other large birds in order to warn pilots of their presence.

Air Force bases have been using a variety of methods to keep the airpatch bird-free. At McClellan, for example, bird squawkers (taped starling distress cries) have been used with some success. The squawkers were installed after a flock of starlings flew into a C-130 causing damage to two of the engines. They are automatically turned on at 0630 and off at 1800.

At Laredo it was discovered that birds, primarily buzzards, were roosting and congregating near a small rendering plant. The base Staff Judge Advocate and the County Health Department were successful in having the plant relocated.

Randolph AFB in cooperation with the U.S. Fish and Wildlife Service has one of the most ambitious programs we have heard of. Here are some of the methods they have been using:

- Frequent mowing around the runways and airfield to provide less cover and food for birds. This is a continuous operation.
- Periodic controlled bird shoots in open field and designated roost areas. Only limited effectiveness; it is inadvisable to carry out large scale shooting operations in the base housing areas where most of the birds roost.
- Destruction of bird nests in roosting areas by flushing them out with fire hoses. Most effective during hatching season.
- Experimented with greased ropes (poisoned) in hangar lofts for sparrow control. Unsuccessful; the birds would not sit or roost on them.

So much for the birds. They are clever, cunning and tenacious. And, for the present at least, they cannot be completely controlled. But a good bird removal program will help and might prevent a serious accident. As more information becomes available, AEROSPACE SAFETY will keep you advised. ★

TECHNICAL ASSISTANCE in combating bird problems may be obtained from Regional Offices of the Bureau of Sport Fisheries & Wildlife, at the following addresses:

1101 N. E. Lloyd Blvd
P.O. Box 3737
Portland, Oregon

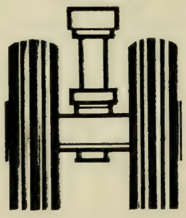
906 Park Ave., S. W.
P.O. Box 1306
Albuquerque, New Mexico

1006 West Lake St
Minneapolis, Minnesota

620 Peachtree St
Atlanta, Georgia

1105 Blake Bldg
59 Temple Place
Boston, Massachusetts

T39



NOSE WHEEL STEERING

C. Livergood, North American Aviation, Inc.
Los Angeles

The T-39 landed and was cleared by the tower to make a 180 degree turn on the runway. Nose wheel steering was engaged and worked fine. As the aircraft started its turn, nose wheel steering disengaged and the aircraft left the runway. With the exception of some frayed nerves, the crew and aircraft came through unscratched.

After a preliminary analysis and a couple of taxi runs to duplicate the original situation, it was presumed that loss of steering was caused by one main gear oleo load switch opening during the taxi turn. However, this was not the case, since opening of either main landing gear oleo switch singly will not deactivate the steering system. This is a design feature that prevents a single (main gear oleo switch) failure from rendering the steering system inoperative.

For the benefit of the more technical types, a look at T.O. 1T-39A-2-8, pages 3-47 and 3-49, will show that depression of either LH or RH main gear oleo switch will energize the CPD relay in zone 5 and close contacts D_2-D_1 in zone 3, thereby completing the power circuit to the nose gear steering control relay in zone 2. If nose gear steering is selected and the nose strut oleo switch is depressed, nose gear steering power is available to the nose gear steering control box in zone 3 and to the steering system hydraulic power and control valve shown on pages 3-48 and 3-50.

The purpose of this article is to review the operational phases of the steering system and to dispel any misconception that a single main gear oleo switch (either broken, disconnected, or misrigged) can render the steering system inoperative. Let's discuss the operation of this dual (main and stand-by) system, a phase at a time.

TAXIING

With the weight of the airplane on the landing gear, the steering circuit may be energized by pressing and releasing either nose wheel steering button (on the outboard grip of each control wheel). Pressing and releasing either button the second time deactivates the steering system. If in doubt, press and hold for nose wheel steering. When steering is available the two green NOSE STEER ON indicator lights are illuminated. For all normal operations, the steering system selector switch shall be in the MAIN position.

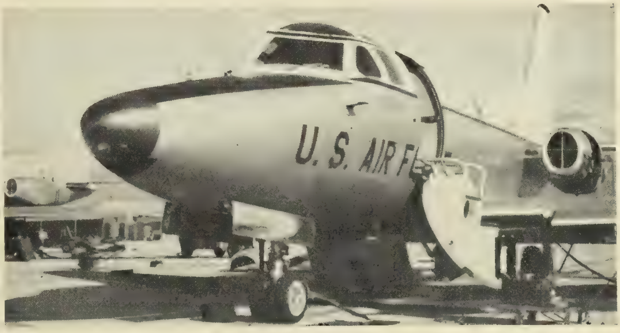
If taxiing over rough terrain or with an overinflated nose gear strut, steering may be momentarily interrupted as the nose gear oleo switch opens and closes. It is not necessary to re-engage the steering system with the steering button each time such an interruption occurs, because steering will be operative as the nose strut oleo switch again closes. Uninterrupted steering is available even if, during a high-speed taxi turn, the inside main landing gear strut extends enough to open its respective oleo switch.

In the event of a main system failure during taxiing, an automatic transfer to stand-by will take place. The transfer is indicated by illumination of the MAIN STEER FAIL and MASTER CAUTION lights. It is recommended that flights not be conducted after a failure of the main system, since a subsequent failure could result in a hard-over steering condition.

If a failure occurs in the normal hydraulic system, the steering system may be powered by placing the AUX SYS hydraulic switch in th ON position. However, remember, when the auxiliary system is used (accumulator pressure only), the speed brake, wheel brakes, and nose wheel steering are all depleting the pressure, and when this pressure is reduced to 1700 psi, the engines should be shut down and the airplane towed back to the line. As a last item, and added only as a reminder, don't forget to check both main and stand-by steering systems during taxiing, just like it says in the T-39 Dash One.

TAKEOFF/AFTER TAKEOFF

At approximately 60 knots, rudder control will begin to take hold and the nose wheel steering system may be manually disengaged. After liftoff and before landing gear retraction, check to ensure that the green NOSE STEER ON indicator lights are out. If failure of the main system and automatic transfer to stand-by occurs during takeoff, the MAIN STEER FAIL caution light and MASTER CAUTION lights may also be illuminated after liftoff. If these lights are not out, indicating steering is still engaged, the nose wheels will turn in the wheel well after gear retraction, with subsequent rudder pedal movement. If this should occur, minor damage could be inflicted to nose gear well equipment. The lights and steering may be de-energized by momentarily placing the steering selector switch at STAND-BY and back to MAIN. If this does not extinguish the lights, do not retract the landing gear.



LANDING

After landing, with the nose gear on the runway, use the rudder for directional control, and when required, engage the nose wheel steering system. The nose wheel steering circuit is energized at main gear touchdown, and may be activated any time after nose wheel touchdown, by the control-wheel-mounted steering buttons. If, for any reason, the left or right main landing gear strut extends, and its respective oleo switch is opened, the steering will not be deactivated. If *either* the left or the right main gear oleo switch (and nose strut oleo switch) is depressed, steering will be available.

If, during takeoff, an automatic transfer to stand-by occurred and it was necessary to cycle the selector switch to STAND-BY and back to MAIN to deactivate the indicator lights and steering system, engage nose wheel steering after landing by placing the selector switch at STAND-BY. If steering is selected in the normal manner (through actuation of either control wheel button), the malfunctioning main steering system may be actuated prior to an automatic transfer back to stand-by steering. Leave the selector switch at MAIN until the nose wheels are firmly on the runway, then place the steering selector switch in the stand-by position.

STAND-BY STEERING

The airplane should not be operated with a known failure of either the main or the stand-by nose wheel steering system. The stand-by is not an alternate system, but is a reserve system which is automatically engaged when the main system becomes defective. Both of these systems function essentially the same. However, the stand-by system has several characteristics not found in the main system. In stand-by steering, the steering buttons on the control wheels are inoperative; therefore, steering will be engaged from the moment of transfer, and the only way to isolate the steering systems completely is to momentarily turn the electrical master switch off or pull the main and stand-by nose wheel steering circuit breakers. If it becomes necessary to completely isolate the steering system by pulling the two circuit breakers after an automatic transfer to stand-by steering, pull the main system circuit breaker first. If the stand-by circuit breaker is pulled first, steering will automatically transfer back to a failed main system.

When operating with a known failed system (main or stand-by) there is no backup system, and, in the case of operating on stand-by with a failed main system, a subsequent failure of the stand-by system will not result in a free-caster condition.

If an emergency condition warrants or if an operational necessity dictates that the airplane be operated with a known failed main or stand-by system, read and understand the instructions provided in Section VII of the T-39A Dash One.

These instructions provide the safest methods of operation. As a last word of advice, when operating with a known or suspected failure of the main or stand-by nose wheel steering system, taxi with caution at a conservative speed, especially in the vicinity of other aircraft and equipment. ★

CROSS CHECK

Maj Donald R. O'Connell, Directorate of Aerospace Safety

Don't fly by the seat of your pants, trust your instruments. This has been the basic philosophy of instrument flying and it is a sound philosophy – if you can trust your instruments. Pilots flying our jet fighters know that it is impossible to fly by the seat of the pants. They also realize that it is becoming harder and harder to trust some of our instruments.

In a 22-month period, 1 January 1964 to 1 November 1965, there were 342 reported incidents of inflight failures of instruments in USAF aircraft. In 1965 there were 58 reported inflight failures of the F-101 attitude indicator. ADC ran a two-month check and found that there were 74 inflight failures of this instrument in the F-101, F-102 and F-106.

Fortunately most of these happened in VFR conditions, but not all. One young troop, 115 hours in the F-101, was trying to punch up through a thin overcast at a high rate of climb when the attitude indicator tumbled. He became disoriented and ejected. Another young pilot, 57 hours in the F-101, scrambled at night. Immediately after entering a 3000-foot overcast he reported that the attitude indicator showed a 90-degree left bank. Stick corrections had no apparent effect so both crewmen ejected. A related incident involved an older troop with over 1300 hours, but only 95 in the F-101. While he was penetrating a thin overcast, his airspeed indicator failed and he thought he had pitched up. Forward stick pressure caused the canopy to leave the aircraft and the resulting flying debris so blinded the pilot that he ejected.

These are only three of the most recent F-101 accidents. There have been others where suspected attitude indicator failures have been contributing factors. There also have been many incidents that easily could have resulted in accidents except that the pilots did an excellent job of recognizing the situation and using other available instruments to recover. A recent example involved an F-101B on a ferry flight. The pilot was flying number two in a two-ship flight and was given separate letdown instructions because of the terminal weather and runway conditions. The pilot said that, because of the weather, he turned the pitot heat switch on before starting the penetration. However, during the letdown the attitude indicator precessed excessively, the airspeed bled off rapidly to 120-130 KIAS and there appeared to be a drastic reversal in the vertical velocity and altitude indications. The pilot closed the speed boards and selected afterburner, but the resulting gyrations caused all gyro instruments to appear unreliable and the off flag appeared intermittently on the attitude indicator. The pilot regained positive G control by using primarily the PBI. The pitot heat was recycled and normal pitot static instrument indications returned. It was estimated that 9000 feet of altitude was lost during this maneuver and the G meter registered plus six, minus two. Preliminary investigation points to icing in the pitot system.

The cause of the failure is not the important factor here; the point I'm trying to make is that the pilot was able to cope with a critical situation because he was able to analyze the situation and use the other reference instruments available. Our instrument training programs emphasize the primary instruments so much and we learn to depend on them so much that we tend to forget we have other reference aids available. It is easy to sit at a desk and second guess the quick decisions to eject. I certainly agree that at low altitude you don't have much time to study the situation; however, at altitude there is normally time to analyze the problem a little more thoroughly and study other indications and indicators.

Many people are working to obtain a more reliable attitude indicator system. Money is the big problem. The Voodoo will start phasing out in the next couple of years, which makes it difficult to justify the expense of an extensive modification program. However, there is a proposed modification of the MD-1 gyro in the mill, and it looks like the components will be made time change items. Also efforts are being made to improve quality control procedures at the overhaul facilities. These actions should improve the reliability of the primary system. In addition, all F/RF-101 A and C aircraft will be outfitted with two-inch stand-by attitude indicators. The indicators are now available and being installed.

On 2 March, AFLC approved a request for stand-by attitude indicators for the B fleet; however, it will take approximately 7 to 9 months to procure them. Effort is being made to decrease this time delay.

In the meantime we are going to have to do the job with the equipment available. Because of this I feel each unit should review its personnel and the training program to see that they match. I think we will all agree that an old experienced head who is flying regularly is more capable of handling an instrument failure situation than the new head. Therefore, it isn't fair to levy stringent training requirements on all units and all individuals. However, it might be wise during this critical period to give additional instrument training, especially in the simulator, stressing partial panel recoveries from unusual positions.

Even though the seed of doubt may have been planted, the odds are tremendously in favor of the instruments. You have to trust *them*. The emphasis is on *them*, and not *it*. Cross-check. ★

discipline

Maj Saul Faktorow, AFSWC, Kirtland AFB, New Mexico

Recently one of our Flight Section Chiefs and I were discussing Safety, what it means and what is needed. He said that discipline is an important part of any good operation. I didn't challenge him but suggested that if everyone did what he knew he should and could do, there would be no need for discipline. "But that is discipline," he replied. I finally got the idea.

Discipline to him doesn't mean punishment. It means self-discipline, adherence to rules and regulations, the use of your own good sense to do a job properly within the limits established by the powers that be.

For the past several weeks I have been particularly watchful of the traffic on base and how it moves. There is no question in my mind that a large percentage of drivers obey the speed laws only when they feel they are being observed. They take short cuts, drive 40 in a 25 mph zone when they think they are not being watched. They have accidents; they do not have self discipline! If caught they will be disciplined.

Rules and regulations are established as guidelines, usually having been developed from past experience. If you don't obey them and you are caught, you may be disciplined. Worse, you may cause injury to yourself or others, damage to vitally needed equipment, and delay or failure of the mission.

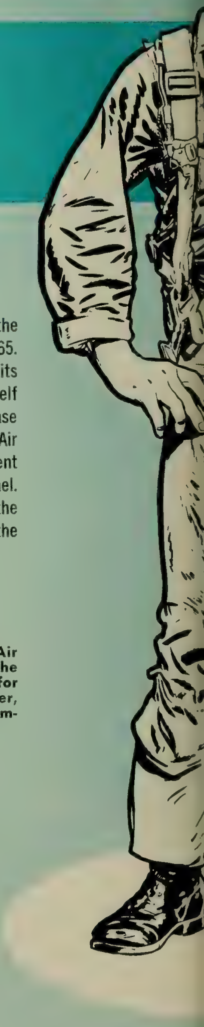
"Self Discipline" can make or break an outfit. Likewise, it can make or break you. It is a responsibility for everyone. A commander by ignoring established directives leads his men to do likewise; a mechanic using the improper size cotter key can destroy an aircraft or vehicle. With self discipline the commander would have taken the time to follow directives and the mechanic would have walked to the parts bin and obtained the correct item. A pilot violates airspace or aircraft structural limits, and there is big trouble, maybe a big loss. A secretary misfiles something—a mission may be delayed waiting for replacement instructions.

I'll be the first to admit that there are regulations and rules that I don't believe are productive. But the proper way to handle them is to get them changed; until then comply with them. I recently saw a good illustration of this. Certain equipment was needed to be carried on one of our newer aircraft. It was prohibited and so was not carried. The men involved stated their requirements in writing. A new study was made; the prohibition was removed.

In summary, exercise self-discipline, follow the rules or, if you can design better rules, have the old ones changed; you might get a suggestion award. You will certainly do a better, safer job. ★

REX RILEY CO

AIR DEFENSE COMMAND

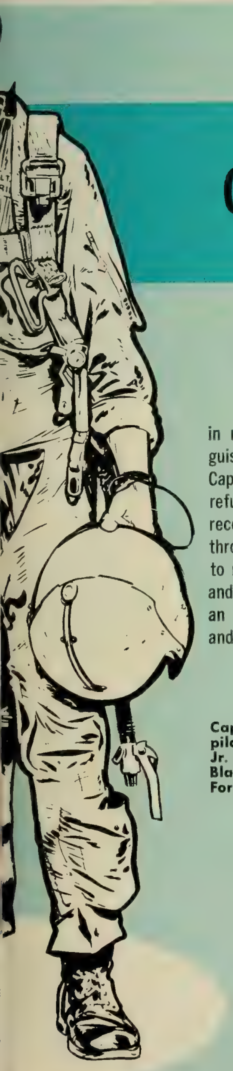


DAEDALIAN TROPHY 1965

The Daedalian Flying Safety Trophy is awarded to the Air Defense Command for having the most effective aircraft accident prevention program of all major air commands for calendar year 1965. During the period of this award, the Air Defense Command established the lowest accident rate in its history. The well defined and effective Air Defense Command accident prevention program proved itself in the successful completion of thousands of sorties flown in special exercises and the unique defense mission. By conserving lives and materiel, while accomplishing its worldwide commitments, the Air Defense Command has made a substantial contribution to the mission of the USAF. This accomplishment was the result of superior teamwork of unit commanders, aircrews, maintenance and support personnel. The achievement made by the Air Defense Command in aircraft accident prevention perpetuates the highest standards and traditions established for the Daedalian Flying Safety Trophy, and reflects the highest credit upon the command and the United States Air Force.

Lt Gen Glen W. Martin, left, Air Force Inspector General, presents the Daedalian Flying Safety Trophy for 1965 to Lt Gen Herbert B. Thatcher, commander of the Air Defense Command.

GRATULATES



CAPT. ROBERT E. WATKINS

KOREN KOLLIGIAN TROPHY 1965

The Koren Kolligian, Jr. Trophy is awarded to Captain Robert E. Watkins, United States Air Force, in recognition of his accomplishment of an outstanding feat of airmanship. Captain Watkins distinguished himself by an extraordinary achievement while participating in aerial flight on 12 October 1965. Captain Watkins was pilot of an F-104 aircraft on a deployment to Southeast Asia. During the fourth refueling at 29,500 feet, the basket assembly separated from the drogue and slid all the way down the receiver aircraft's probe, causing serious damage to the probe head. Captain Watkins remained calm throughout a long, highly involved emergency including materiel failure, inclement weather, and inability to refuel. He finally succeeded in receiving fuel and proceeded to the home station. His courageous action and skill saved a combat ready aircraft. Captain Watkins' outstanding feat of airmanship in coping with an airborne emergency conforms to the high standards established for the Koren Kolligian, Jr. Trophy and reflects great credit upon himself, the Tactical Air Command, and the United States Air Force.

Captain Robert E. Watkins, F-104 pilot, receives 1965 Koren Kolligian, Jr. Trophy from General William H. Blanchard (deceased), former Air Force Vice Chief of Staff.

HILLS HEIGHTS & HELOS

Maj R. A. Bonney, USMC
(Reprinted from APPROACH, October 1965)

Let's say you're a helicopter pilot. If it's a normal day you haven't been thinking much about things that happen above 1500 ft MSL. Then comes a message: A helo trip to the mountains is requested. Well, you're a helo pilot w/helo, so you go — but only after a bit of planning. First, do some thinking in a high level vein.

For all its talent, the helo is comparatively fragile in certain situations, such as high altitude maneuvering and rough area landings (RAL) at mountain sites. At altitude it is not the same aircraft, as many well-qualified "sea level" pilots have found.

Your primary job is to calculate whether the helicopter is capable of completing the task. Consider the load: What kind and how much?

Then, what about the destination? This involves more than just direction, and distance from home base. Preferential helo routes are seldom direct and generally twist around through valleys and passes for lowest enroute altitudes. Examine the charts for your route *before* climbing into the cockpit.

Evaluate the elevation of your destination. Wind and temperature are necessary for planning but if you have up-to-date information you are lucky. Without on-site data, use no wind and estimate temperature from time of year and time of day then add a few degrees for a cushion.

Terrain itself must be considered. Is the landing site a wide, flat meadow or a skimpy ridge which gives you cheese parings and candle ends for a touchdown space?

When these elements are all taken into account, an uncomfortable situation may result. Here's why.

For getting a job done, a lot of people think in terms of a helo. The natural flexibility of the machine allows it to perform tasks with an apparent ease which makes other methods time-consuming or cumbersome by comparison. Consequently there is a temptation to assume the helo can do just about anything – and it can, within its operating envelope. As a helo pilot it might be your task to temper enthusiasm with cold facts on allowable payload versus altitude or fuel weight required.

Also, you must be suspicious of a landing site that the ground party has picked out until you have seen it yourself and can judge it as adequate. Enthusiasm for the helicopter's abilities gives people the tendency to overestimate its capabilities. For example, the site may appear satisfactory from the ground but be unsafe for the pilot because there is no waveoff "escape or abort route."

It is true that a helo pilot can be diverted from a low altitude flight up to the hills without any chance to run weights and altitudes through his Flight Manual. In this case you should have done your homework and established some estimates on what is possible.

As important as planning is, it is no guarantee of success. There has to be some headwork involved when the actual operating area is reached. Since 1 July 1962 helicopter mountain operations figured in 29 mishap reports. Twenty accidents have resulted because pilots were unable to cope with the high density altitude, vertical currents and turbulence associated with unprepared landing sites.

As an example of planning plus headwork let's take the case of a fairly experienced pilot with 1200 total hours and 1000 helo hours.

Elevation of a mountain camp site where cargo and personnel were to be delivered was 3000 ft MSL. The pilot calculated that the aircraft was capable of hovering *in* ground effect at that altitude (density altitude would be about 5000 ft). Since the weight was such that the helo would not hover out of ground effect, the pilot had a "fixed-wing" situation on his hands. He *had* to keep a certain amount of forward speed. However, he had been into the landing site a number of times and no difficulty was anticipated.

When about five miles from the landing site, the pilot observed clouds in the vicinity of the mountain top. He continued inbound but turned back when he saw the site was obscured. This was in accordance with briefed procedures.

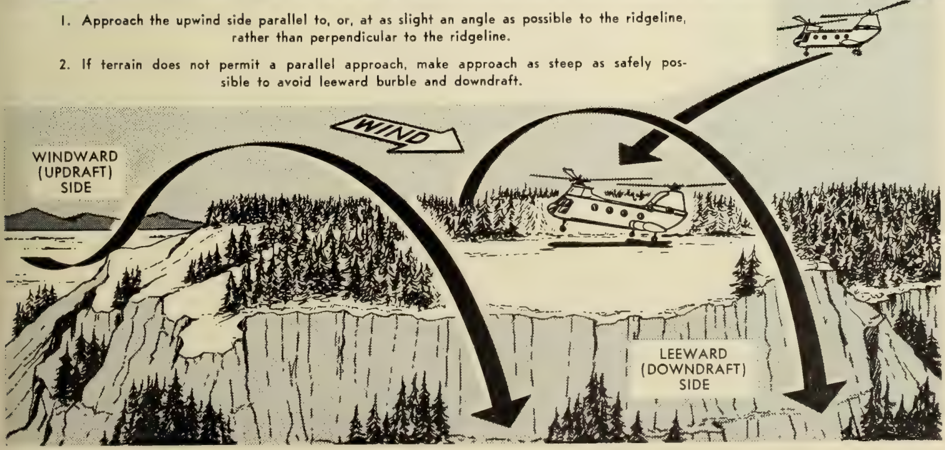
Then the clouds broke and the helo was maneuvered into a long straight-in approach. When close to the site, clouds again covered the area. The approach was continued while reducing forward speed in the hope that the landing area would clear.

Unfortunately, the landing area remained obscured and about the time a decision was made to discontinue the approach, the airspeed had fallen to the point that the helo began losing altitude. Full throttle failed to prevent it from settling slowly into the trees.

The accident board confirmed that under identical conditions flight could *not* be sustained without translational lift (forward speed) or ground effect. When forward speed was reduced below that required, settling was inevitable. Without adequate airspace above the terrain, a waveoff was not possible.

In effect, the pilot simply painted himself into a corner. But consider what one of the chain-of-command said in an endorsement:

WIND EFFECT ON RIDGELINE APPROACH



1. Approach the upwind side parallel to, or, at as slight an angle as possible to the ridgeline, rather than perpendicular to the ridgeline.
2. If terrain does not permit a parallel approach, make approach as steep as safely possible to avoid leeward burble and downdraft.

HILLS HEIGHTS & HELOS

continued

"This is a case where a pilot, well experienced from the standpoint of hours in type, failed to cope with a variation of the unpredictable situations so frequently encountered in mountain terrain. In mountain terrain the winds, shifting cloud cover, variations in temperature and humidity are seldom reported for the actual area of the intended landing site.

"This is undoubtedly the greatest area of challenge to the helicopter pilot; that of attaining and perfecting his judgment and technique to the point of being able to operate the helicopter through its full range of flexibility."

Air Force helicopters are frequently called upon to fly missions in mountains. This article provides some good advice.

These words deserve a little more attention, because they lead into another aspect of helo mountain flying. It is perfectly logical for a pilot to want to operate his aircraft through its full range of flexibility. And as long as people are human, the "sea level" helo pilot will sense a challenge toward the high altitude portions of his flight manual graphs.

Shortly before noon on a warm, July day, a West Coast air station received a request for an immediate helicopter search mission into a nearby mountain range. The request passed through several people and after the pilot was told of the situation it had taken on an urgent nature in his mind. The helicopter had previously been preflighted and turned up, and 16 minutes after the search request originated, the aircraft was airborne with a total of five people on board.

The pilot had a total of 2000 hours with 150 in helos. This would be his first mission in mountainous terrain as aircraft commander. He had one previous mission as copilot operating at 3000 ft MSL in mountainous terrain.

Objective of the search was some equipment which had dropped in a remote area on the side of a mountain. When the equipment was sighted the pilot radioed the location back to base. He was asked to land if at all possible and discharge two men from the helo who would then attempt to recover the equipment.

A Ranger Station on the top of a 6000-ft mountain appeared to be the nearest possible landing site and the pilot advised he would land there and discharge the two-man recovery team.

Here is an appropriate place to review the guide lines for mountain and rough terrain flying:

- Make a continuous check of wind direction and estimated velocity.
- Evaluate temperature with the thought that it may increase as you get close to the ground.
- Plan the approach so that an abort can be made downhill and/or into the wind without climbing.
- If wind is relatively calm try to select a hill or knoll for landing so as to take full advantage of any possible wind effect.
- When evaluating a landing site in non-combat operations, execute as many fly-bys as necessary with at least one high and one low pass before conducting operations into a strange landing area.
- Evaluate the obstacles in the landing site and consider possible "null" areas (loss of wind effect on downwind side) and routes of departure.
- Landing site selection should not be based solely on convenience but consideration should be given to all relevant factors.
- Make a power check: Determine power available and ability to hover out of ground effect prior to attempting a landing.
- Whenever possible, approaches to ridges should be along the ridge rather than perpendicular.
- During the approach smooth movements of the controls are essential. Movement of the controls in a sharp or abrupt manner may lead to loss of RPM.

Now let's see what happened at the Ranger Station.

The pilot circled the area twice while checking the wind and evaluating the landing site. A shallow approach to a hover was decided upon and the H-34 came in with 2700 rpm, approximately 25 inches MAP. It began slowing to approximately 30 kts, 50 to 100 ft above the ground and short of the intended landing site.

As the aircraft approached a hover, the pilot applied 40 inches MAP (full throttle position) at which point the aircraft began to settle with rotor RPM starting to decrease.

When RPM passed through 2200, the pilot warned the crew and passengers that they were going in and he applied maximum collective prior to touchdown. The helo hit hard, landing on an approximately 15-degree incline 200 ft short of the landing site. Fortunately, there were no injuries. The Ranger Station was found to be abandoned.

Although it does not sound as if the pilot made any gross errors, a comparison of the mountain helo guidelines and his actual procedures does show some omissions.

In orbiting the landing site the pilot estimated the wind as calm but made no estimate of the air temperature, except to note that it was "warm." Later calculations of the conditions gave a density altitude of 8000 ft.

No check of "power available" was made prior to commencing approach thus the pilot did not know how close he was to maximum under prevailing conditions.

The approach was too shallow to provide an adequate abort route in the event of unforeseen difficulties.

These were small details but important ones. According to the graphs and charts, the aircraft should have been able to do the job. In actuality it was being asked to operate at the top limit of its capabilities.

The stranded pilot's statement throws some light on this aspect. "At about 1515," he said, "two helos arrived at the crash scene, one Coast Guard and one from a naval air station (NAS). The helo from NAS made several passes and finally came in from the north. By this time a 10-kt southerly wind had come up.

"I set off a smoke bomb to give the pilot further wind direction. He came into a hover and lowered the sling. My crew looked rather apprehensive that another helo of the same type as ours could hover and pick up anyone. I handed my flare to one of the crewmen and ran out and got in the sling.

"As I was pulled into the cabin, I felt the helo start to settle. We hit the ground and I bumped my head on the overhead. I got out and talked to the pilot, advising him to come back later in the evening when it was cooler.

"He took off and another NAS helo appeared to be coming in for a landing try but we waved him off. The Coast Guard helo then came in and picked up one man. A short time later he was back, minus a co-pilot and internal gear and he picked up two men. On his third trip, the remaining crewman and I were picked up.

"In my opinion this accident could have been prevented had I refused the request that I land. *(Once the equipment was located the urgency of the mission decreased but this was never passed to the pilot.—Ed.)* I believe that I used proper procedures, but that the performance required of the helo was on the borderline of performance available. It is possible that had I made a precision type approach from a higher altitude, that I would have discovered the power deficiency early enough to have effected a waveoff."

Pilot's first high altitude landing ended short of destination.

What can you as a helo pilot learn from this accident, especially if mountain flying is not yet in your logbook? First of all, if you hunt hard enough through the Flight Manual, you will find a caution that the performance figures to be derived from the Appendix are guides, not decimal point guarantees. Secondly, what does the helo pilot have the most control over? Weight, of course.

So, load your aircraft to leave a healthy margin for error. If calculations show a proposed flight will be at the max limit, the apprentice mountain man may want to divide the load and make two trips instead of one. Decide if it is mandatory to have the tool box and crew chief as payload. As experi-

HILLS HEIGHTS & HELOS

ence is gained work toward maximum effort. Mountain helo flying is *advanced* flying. You're doing nobody a favor to settle into the ground short of destination while learning the ropes.

The number one guideline for mountain and rough terrain concerns wind; make a continuous check of direction and estimated velocity. Naturally this is not an exclusive rule for extreme elevation. It applies right on down to sea level. (Several classic cases of adverse wind effect on helos have occurred in the vicinity of the blimp hangar at Lakehurst, elevation 91 feet.) Wind flow in hills and mountains is a problem because of its erratic, unpredictable nature. However it does follow certain laws.

Wind action is given various names from the type of terrain. "Channeling" may occur when the wind flow is across a valley, but not at a right angle to it. The surface wind direction may turn parallel to the valley.

Light winds can often become much stronger when they are forced to converge and "funnel" through a narrow pass. Other local "deformations" of the air mass occur as it flows through a gorge or over a hill.

To further complicate the local wind flow, the valley-slope circulation must also be considered. During the day, the air over the slope is warmer than air at the same height over the valley. The rising of this warmer air creates a well-defined wind up the slope. The reverse is true at night, and the colder air over the slope flows downward into the valley.

The air within the valley becomes warmer during the day, and rising, is replaced by air from the plain. During the night a reversal occurs, and the air flows down the valley out to the plain. Slope and valley circulations decrease with height and disappear completely at about the tops of the ridges forming the valley.

A very localized feature is the heating of one side of a valley, as by the morning sun, while the other side remains in shadow. This may result in overturning of the air (warmed air rising on the sun side and cooler air sinking on the shaded slope).

Unfortunately, these typical terrain-temperature situations are not what the helo pilot often finds. One pilot attempted a rough area landing in a box canyon and as he got close to the spot he settled into the ground unexpectedly. Later it was found that when descending into the box canyon under conditions of light wind, there was a rapid rise in temperature with a difference of seven to eight degrees from the surrounding area.

Then there was the helo pilot who attempted to takeoff near a fire area. He was unsuccessful because of one small detail. The nearby flames had increased the local temperature beyond the helicopter's operating capabilities. So when mixing heights, hills and helos, nothing is ever likely to be normal.

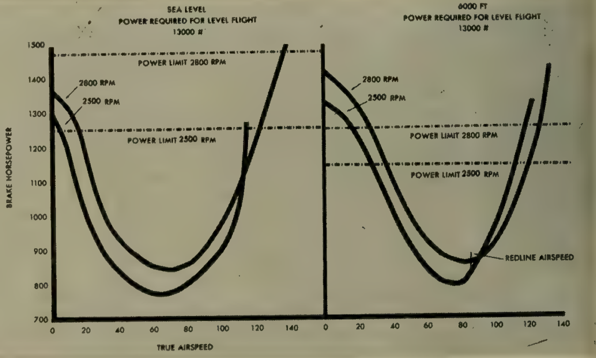
From the beginning of helicopter training, pilots are taught to "keep your turns up." Rotor RPM is the critical factor since it determines the air velocity over the blades. Engine power keeps the rotor blades turning and horsepower is a function of engine RPM. At lower airspeeds it takes more power to go slower. The elements of this triangle (airspeed, power and RPM) are shown on the charts below.

The charts are approximate for an H-34 but are only a representation and should not be applied to specific problems.

An approach to a rough area landing or at high altitude is usually made with maximum allowable RPM (2800 for the H-34). However, an examination of the actual charts in the H-34 Flight Manual shows slightly better weight lifting

The curves at right are approximate for the H-34 and illustrate the power available and power required for two rpm's and two altitudes. Weight is constant at 13,000 pounds. At sea level and 2500 rpm, power available is less than power required to hover out of ground effect. At 2800 rpm there is 100 brake horsepower in excess of hover requirements. Somewhere before the RPM deteriorates to 2500 rpm the helo will fall.

At 6000 ft hovering out of ground effect is not possible.



capability with 2700 rpm. Why then, is maximum RPM used for approaches?

It is easy enough to lose RPM but rougher than a cob to try to increase it when you are committed. If you start with a high RPM and lose a little, for example from 2800 to 2700 rpm, your position has not been hurt — if no more RPM is lost. Curves on the charts show the results when too much RPM is lost; the power limit or power available decreases.

Note that on the charts minimum power required for level flight is from 60 to 70 kts TAS (bottom of the curves). Using this speed range gives the maximum excess brake horsepower available, 640 excess BHP at sea level at 2800 rpm for example. Therefore, best climb will be at that airspeed which provides maximum excess BHP and it is not mere coincidence that the H-34 NATOPS/Flight Manual says climb at 70 kts. (NATOPS-Navy Air Training Operations Procedures.) A recent accident shows the possible consequences when such a point is overlooked.

The flight was a logistic support mission with cargo to be picked up at a mountain Ranger Station heliport and then carried to a site further into the mountains. Upon arrival in the vicinity of the Ranger Station, the pilot made a low and slow approach and personnel on the ground were able to point out hand signals. The site was a cleared the direction of the heliport by area on a slope approximately 450 ft higher than the Ranger Station and approximately 1500 ft distant.

After spotting the landing site, the pilot turned, departed directly toward it, and commenced climbing. "In starting a 40-kt climb to the landing area," he said, "I pulled about 45 inches MAP with approximately 2600-2700 rpm.

"The climb seemed to start normally. Then I noticed the airspeed drop off and the RPM begin to deteriorate. To my recollection I had not increased power."

Witnesses noted that as the aircraft neared the landing site, the rate of climb appeared to diminish in relation to the terrain. The helicopter then veered slightly right, clearing a ridge which projected from the landing site. It passed near the landing site and proceeded into a rapidly rising box canyon. The aircraft settled to the floor of the canyon and caught fire but none aboard were injured.

The steps which led to the point of impact are summarized by a paragraph from the accident report: "Progress of the flight was normal until the aircraft transitioned from a near hover over the Ranger Station to a low airspeed, steep climb over rapidly ascending terrain with a quartering tail wind."

Based on the information in the NATOPS/Flight Manual and the prevailing conditions in the area, the accident board determined that the maximum increase in altitude that could be attained in the distance involved (maintaining 40 kts and 45 inches MAP) would be approximately 325 ft. The altitude gained did exceed that 325 ft but airspeed and RPM were sacrificed for altitude in order to remain clear of the terrain.

In so doing, the aircraft entered an emergency condition. When the pilot recognized the fact, he attempted to recover by dropping the nose, increasing throttle to full on, and lowering the collective. This action was taken well past the effective recovery point and the aircraft settled into the trees.

By referring to the power curves previously discussed, you can see that the three elements of Power, RPM, and Airspeed result in a tricky triangle. The effects can be summarized as follows:

- Power required increases very rapidly when the airspeed falls below the minimum power required airspeed (approximately 60 kts TAS).

- Power required does not vary much with altitude.

- Power available changes rapidly with changes in altitude.

- An increase in either RPM or airspeed will increase amount of excess power or decrease a power deficiency.

- An increase in both airspeed and RPM will make a startling change in power excess at any altitude. ★

The last moments of 303. Seconds later a climb toward heliport ended in trees. (See text.)

THE LAST DE

Although flight and ground safety have been emphasized more and more during the desi
phases of the aircraft business, the final decisions which directly affect fli

New aircraft, such as the General Dynamics F-111 (*Aerospace Safety*, December 1965), have received repeated consideration of the various aspects of safety; but the man at the throttle has the last look and the last decision. These determine the fine line between life and death of man and machine. The reasoning behind these decisions should be as sound and objective as the reasoning that goes into the making of the machine.

A "kick the tire, light the fire," attitude will hardly hack the decision course. Still decisions are often made with such reasoning as, *"the airworthiness of the aircraft is directly proportional to the desirability of the mission."* This is an axiom that can be developed when the flight crew makes judgment of an aircraft flight condition in a subjective rather than objective mood. Flight crews are not the only people involved with flying who are exposed to decisions regarding aircraft flight safety, but they are most often the victims of unsound decisions. It then becomes most important that a flight crew decision regarding safety be sound, and as free as possible of those factors which influence subjective thinking.

The chain of safety begins with the initial concept of an aircraft design and continues on through the actual design, the prototype, manufacturing, testing, changes, delivery, operation, inspection, maintenance, overhaul, modification, preflight and flying of the aircraft. Each of these major phases consists of hundreds of lesser operations such as the making of a single rivet or strand of wire. And each of these operations requires other major operations like the manufacture of the machine that makes the rivet. The total idea can be regressed all the way back to the gathering of the basic ore from which the aircraft parts are made. This transition from the depths of the earth to the unlimited heights in space requires thousands of cogs in the giant machinery that produces an aircraft and demands that each cog work nearly perfectly. From each cog, and from each man involved in that cog, the base line of the safety curve is plotted. For each flaw that is created because of subjective thinking, or other reasons, the margin of safety grows smaller and the responsibility of the flight crew broadens.

In many cases, flaws or inherent defects that are created through any of thousands of ways are so small and so insignificant that they will never cause trouble. Other defects, normally dormant, will react when some specific set of circumstances conspires to demand unusual performance. It may be that this is the type of failure that causes an aircraft obituary to end in "cause undetermined."

As the aircraft progresses from design to operational use, many decisions are made. These decisions are made by humans and are subject to the foibles and fallacies of human understanding. A designer leaves off a line of a drawing because he is in a hurry to get to an anniversary dinner. The drawing progresses without the omission being noticed and a part is made. The part fails and through the normal UR reporting system a new, beefed up part is made. A TCTO is issued to change all existing parts to the newer part with a new dash number. A clerk is interrupted while typing an order and leaves off the dash number. A condemned part is sent to the field and installed in place of another part that is exactly the same. The inspector checks the work, fails to check for the dash number and the aircraft is cleared to fly—still in the same condition it was in before the part was changed. After a few flights, circumstances develop wherein the part is required to perform at its maximum and it is not strong enough. It fails and an aircraft and crew are lost.

One man in a hurry, others complacent, momentary distraction of a clerk, an inspector is too routine, and then — monumental disaster!

If such an event can be built into an aircraft, then it behooves the flight crew to practice flight safety to the utmost so that the curve of safety remains well above the base line. Judge harshly those things about the aircraft which you can see, for there are many things about the aircraft which you can't see and are not privileged to judge.

Usually it is not the big killer items that are accepted for flight when they are known to be marginal. Rather it is the small things that insidiously sneak up and suddenly become as deadly as the bigger items. If a collection were made of last words that preceded infamous flights that ended as "cause undetermined," it might contain such things as:

- "It'll hold together until we get to Madrid . . . we'll change it there."
- "Who wants to RON in this hole? Let's press on."
- "I'll sign it off for a one time flight just to get your requirements completed."
- "If the wind holds, we can overfly."
- "George said he thinks it's O.K. and he's been flying these birds for years."
- "If it doesn't control on takeoff, go to fixed pitch and we ought to make it O.K. like that."

SION

ufacturing and maintenance
ty will rest with the flight crew.

Grover C. Tate,
General Dynamics, Ft. Worth

- "Rules and regulations are only guide lines."
- "I don't have the latest charts, but this one should be O.K".
- "If it takes eight hours for that strut to go flat, it should be O.K. for landing when we get there 'cause it's only a six hour flight."
- "It's an external leak and besides that, we have plenty of extra fuel aboard."
- "Just take the bulb out, it's probably a circuit malfunction."

These quotations are not necessarily verbatim, but are pretty close. Each time a go-no-go decision is influenced by this type of thinking the curve of safety goes down. Because the sum total of all of the safety of the aircraft comes to a focal point with the flight crew, it is the responsibility of the flight crew to discharge that responsibility in the most professional manner of which they are capable.

Although helmeted heads are in the clouds, the booted feet of flight crews should be firmly planted on the ground when decisions are made. Personal desires should not influence these decisions and an oil leak at Gander should be considered just as serious as if it were at Orly — although the RON possibilities are not nearly as bright.

Mr. Einstein noted that all things are relative and are influenced by the observer. As flight crew, we are particularly susceptible to that relativity and our evaluation of the safety of things can be influenced by circumstances. Those pieces and parts that are unsafe on Tuesday are just as unsafe on Friday, so keep the safety curve solid and constant and stay around to enjoy those softer curves that are not so constant. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q How will the new SID criteria affect aircraft operation? For example, if my aircraft will not meet the climb gradients specified on a SID, will I be authorized to fly that SID?

A No, you will not be authorized to fly that SID unless you have a waiver from your Major Command. However, there are several alternatives from which you could choose that would be authorized.

1. Select another SID with specified climb gradients you can meet or select a SID with no climb gradient specified at all. (NOTE: Only climb gradients of 150 feet per NM and above will be specified on a SID.)
2. Reduce aircraft weight so as to be able to meet the specified climb gradients.
3. Request a VFR climb (weather permitting). Naturally, the responsibility for clearing all obstructions rests with you.
4. Request a radar vectored departure, if available. Remember, however, that the radar controller probably does not know your aircraft's climb capabilities as well as you do. Also, obstruction clearance criteria for radar departures have not yet been developed. A radar departure, therefore, will not increase your aircraft's capability to clear obstructions.

Q Assume the situation where a published TACAN holding fix is not collocated with the associated Initial Approach Fix (IAF). If I have been cleared from my present position direct to the holding fix and subsequently receive clearance for the penetration/approach, should I alter my heading and proceed direct to the IAF, or should I proceed on to the holding fix and then to the IAF?

A Proceed via your last route clearance which is direct to the holding fix. If you desire to proceed direct to the IAF, request amended route clearance as such.

Q Holding pattern entry procedures specifically state: "All turns *during entry* to the holding pattern will be made at a rate of three degrees per second or 30 degree angle of bank, whichever requires the lesser angle of bank." Some aircraft are capable of turning at a rate of three degrees per second using less than 30 degrees of bank, particularly at low altitude. In a no-wind situation, after the initial turn to enter the holding pattern, should these aircraft use 30-degree angle of bank or a turning rate of three degrees per second for the remainder of the turns in the pattern? *(Capt Richard H. Deitz, 3501 Pilot Training Squadron, Reese AFB, Tex.)*

A Use either three degrees per second or 30 degrees of bank, whichever you prefer. For ease of timing in the pattern you may want to use an angle of bank equivalent to three degrees per second.

Q Often a TACAN Initial Approach Fix is formed by the intersection of a holding radial and the peneration/approach arc. (Pease AFB, low altitude TACAN-1; Griffiss AFB, high altitude TACAN-1). After clearance for the approach from the holding pattern, should I apply a lead point and turn onto the arc, or should I proceed to the IAF and then turn to intercept the arc?

A Apply a lead point and turn onto the arc. It is more important to turn so as to intercept the centerline of the arc than it is to cross the IAF exactly. Many TACAN arc penetration/approaches have a built-in lead point depicted on the approach chart. (Lemoore NAS, low altitude TACAN-1; Bergstrom AFB, high altitude TACAN-3). However, it is up to the pilot to determine the lead point required. Techniques for determining lead points for 90 degree arc interceptions were discussed in the February 1966 IPIS Approach. However, if you know your approximate turn radius in nautical miles, you already know your lead point (no wind). A turning performance chart which provides turn radii for specific values of bank angle and TAS is included in Chapter 8 of AFM 51-37.

POINT TO PONDER

We have recently overheard discussions involving the direction of surface winds — whether they are reported in true or magnetic degrees. This could be a significant factor when computing a crosswind component for areas of large magnetic variation, e.g., McChord AFB (22 degrees).

Locally disseminated surface wind information (Approach Control, GCA, tower, telautograph, television, etc.) has the variation applied and is magnetic.

All forecast surface winds and winds on the longline teletype will be true degrees. Also, existing destination wind obtained from an *en route* METRO will be true degrees, since this information is taken from the teletype sequence.

By the way, have you noticed that depiction of magnetic variation has been deleted from terminal instrument approach procedure charts? ★

Missilanea

A LESSON TO REMEMBER—A certain Air Force space booster launch complex is located within a few hundred feet of an aircraft parking ramp and taxiway. During the actual propellant flow of a dual propellant loading (DPL) exercise, a transport aircraft started engines and also taxied very close to the launch pad.

An accident did not occur but safety was jeopardized and safety procedures were violated: The DPL and the aircraft flight departure were not effectively coordinated. The pilot did not meet his established takeoff time, the flight operations officer did not enforce the takeoff deadline nor request a hold on the DPL countdown, and the Missile Safety Officer did not delay the propellant flow, although both telephone contact and closed circuit television surveillance existed. Folks were duly embarrassed. You may be sure that additional emphasis was placed on the need to comply with safety procedures.

The point of this story is not that some mistakes were made, but that a valuable lesson can be gleaned from this example. There are times when control of a situation is gradually eroded, then completely lost. When individuals are in the process of working themselves into some sort of corner, there is seldom an early, overpowering warning which is sufficiently forceful to attract just anyone's attention.

Most people, especially those knowledgeable in the field, become concerned sufficiently early that something may be amiss. Nevertheless, an inability to "bite the bullet" sometimes persists until control is lost. Trouble, at its inception, often is not fully and clearly recognized. Usually only a germ of an idea exists which must be developed. The lesson to remember is that when doubt or concern first appear, safety representatives must have both the resolve and self-discipline to meet the problem with deliberate analysis. They must strive to be deliberate rather than dependent on hope to "muddle through" in thought processes needed to "stay ahead of the airplane." Control of dangerous situations can then be maintained through timely, confident and decisive action.

Colonel W. R. Sturm
Directorate of Aerospace Safety

READY-AIM(9B)-FIRE. Everyone knows that checklist deviations and loaded missiles don't mix. When they do mix, the missile comes out second best, down for the count by a low blow to its vital parts. Such was the case in this story. Picture a normal preflight and loading of an AIM9B missile on the right pylon and a HVAR (High Velocity Aircraft Rocket) on the left pylon of an F-104C. By all indications the preflight and loading came off exceptionally well. The airmen involved then attempted to run a voltage check on the HVAR *after* the loading since two HVARs had malfunctioned on this aircraft previously. Because the AIM9B had already been loaded, the checklist deviation occurred at this point.

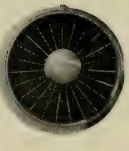
The airman set the selector switch to the left hand position and pulled the trigger. Sure enough, 28 volts appeared at the left hand pylon. However, 28 volts also appeared at the right hand pylon and fired the AIM9B Guidance and Control Unit. (Fortunately the missile had been properly safetied so the motor didn't fire.) Although the malfunction could not be duplicated (the 28 volts should not have appeared at the right hand pylon under the conditions stated), the fact remains that had the checklist been followed and the AIM9B not loaded, the incident could not have occurred. If this was an attempt to do maintenance the missile should have been downloaded. A serious accident was prevented only by the safety pin. Remember, many accidents result from an accumulation of faults or deficiencies. In this case, the check list deviation and the equipment malfunction were two of the three factors needed to fire the missile.

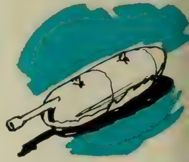
To quote from H. D. Mytinger, OOAMA, "A Technical Order is an order. In the Air Force, an order is an order regardless of whether it relates to combat operations, daily routine or technical matters.

"Like any other military order a Technical Order must be carried out completely, consistent with capability, safety and exigencies. Many accidents and incidents (such as the one above) can be traced to someone's failure to strictly observe TO requirements. Such failures are dangerous breaches of discipline which may hamper the mission and endanger lives. . . . At the same time, it is the duty of all concerned to be critical enough of a TO to detect any shortcomings it might have and to report them promptly and in accord with appropriate directives (TO OO-5-1)."

We think this is excellent advice and wish to pass it on.

Capt R. A. Boese
Directorate of Aerospace Safety

AER  BITS



AFTER A MALFUNCTION in the electrical system of an SUU-16A gun pod, it was found that particles of steel wool were shorting certain pins in a cannon plug. The plug was cleaned and functioned normally. As a result of this incident the installation is requiring that dust covers be used to cover exposed connectors whenever cannon plugs are disconnected. Also, it is only common sense to carefully examine both connectors prior to mating to make sure no contamination is present.

AFTER LANDING, a C-135 inadvertently taxied over a drag chute. The pilot notified the tower of the chute location and recommended pickup. The aircraft then took off again and flew for over three hours. Postflight inspection revealed the drag chute around the nosewheel and numerous holes and dents on the underside of the fuselage. The damage was caused by continuous striking of the drag chute connector link against th underside of the fuselage while the aircraft was in flight.

Drag chutes should be picked up a soon as possible. In addition, at this bas when a chute is reported for pickup an can't be located, baseops will be notifie to stand down all aircraft until the chut is located.

FSO PHOTOGRAPHER—That's right! The FSO gets busier and busier. TA-142 was published in November 1965. An all commands message from SAAMA has added a 16mm magazine load motion picture camera to the list of items authorized in this FSO Table of Allowances.

Now that we have the FSO equipped, how can he effectively use this equipment? Here are some suggestions:

Polaroid Camera:

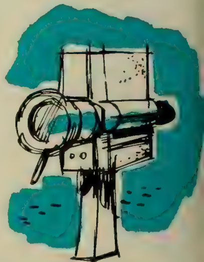
- Aircraft incident/accident damage for immediate review by FSO and the commander.
- UR and Failure Report verification and documentation.
- Adverse airfield conditions such as ramp, runway and taxiway condition.
- Possible FOD hazard and/or areas.
- Vehicular and aircraft parking conditions or violations.
- Improper location or positioning of aircraft support equipment.

Motion Picture Camera:

- Barrier engagements.
- Emergency landings.
- Traffic patterns and landings for use at Flight Safety Meetings to encourage pilot discussion.
- General airfield activity of aircraft and other vehicular traffic to show any deficiencies and possible accident producing habits.
- Bombing/gunnery range patterns.

The general concept of photographic documentation is to provide material to point out problem areas and verify need for improvement. Study of problem areas can be enhanced through the use of the photographic medium.

When properly and intelligently utilized, these cameras will be a valuable contribution to the prevention of aircraft accidents. The final ingredient? FSO (photographer), Primary Duty: Accident Prevention.



Lt Col Richard R. DeLong
Directorate of Aerospace Safety

RAIN, RAIN . . . It's just about that time again when, in many parts of the world, we will be experiencing short but heavy torrential type rains in our operating areas. Annually, during this time period, we experience various problems with landing and airfield operations, and accident potentials increase. This is especially true in operating on semi-prepared strips where our assault type aircraft (C-130, C-123) are carrying the load.

Since areas adjacent to taxiways are, in many cases, excellent places to get stuck, caution should be exercised when taxiing. In addition, heavy pools of water on the runway can be extra hazardous during takeoff and landing phases. Particular attention should be given to the RCR factors in the appropriate Flight Handbook.

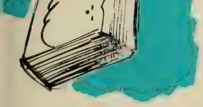
Last but not least, don't forget that any aircraft can hydroplane if conditions are right. Happy puddling!

Maj William M. Bailey, Jr
Directorate of Aerospace Safety

F-101—AS POWER was advanced to military for takeoff, there was an explosion, flames engulfed the cockpit area and the right engine appeared to have flamed out. The engine was immediately shut down and the takeoff roll terminated.

During the walk-around inspection prior to this mishap, the external fuel tank cap appeared to be okay but the pilot asked the crew chief to check it and make sure it was secure. This was done and the crew chief verified the cap as being tight. During the investigation that followed the incident, it was found that the fuel cap was forced out of the filler neck when the tank was pressurized, which allowed fuel to be sucked into the right intake duct causing an explosion and compressor stalls. The cap was defective and the aligning ears designed to assure the cap is in a locked position were bent. This made it impossible to determine whether the cap was locked.

A check turned up no other defective caps but the unit adopted a policy of leaving the caps on the tanks permanently both for servicing and defueling. Other actions are to paint marks on all caps to indicate proper installation and a stenciled warning that, if a cap is removed, the aircraft will be put on a red X until it is re-installed.



SURVIVAL RADIOS—After the pilot of an F-100 ejected he attempted to use his URC-10, not realizing that with his URT-21 operating, reception on the URC-10 was blocked. Here's the situation, according to our electronic experts: With both radios operating on 243.0 mc, direction finding will not be particularly affected as long as the two radios are in close proximity; however, reception on the URC-10 would be difficult, if not impossible, because the warbling tone of the URT-21 will be jamming the URC-10 receiver.

Probably the best method would be to use the URT-21 for a beacon, turning it off occasionally to attempt voice contact with the URC-10. Unfortunately, if you have only a URT-21, there is no way of knowing for sure whether it is working. But with a URC-4, 10 or 11, the receiver will indicate whether the URT is transmitting. Leave the URT on continuously except for the period when contact is attempted on the URC-10 or any of the other transceivers. With careful planning, assuming the batteries in both radios are good, one should get four days of almost continuous transmission. Caution: Don't attempt to extend battery life by operating a radio for just a couple of minutes and then shutting it off. This makes it difficult, if not impossible, for searchers to get a fix.

AERO BITS

AS THE F-4C was backing off after a midair refueling, the pilot felt a slight bump, similar to a compressor stall, in the left engine. Shortly, the instruments indicated a flameout. As the aircraft descended to 15,000 feet, several airstarts were attempted without success. Landing was completed on the right engine. Cause of the flameout was a sheared male spline in the fuel pump.

AS ANY HOUSEWIFE can tell you, a bad plug on the coffee pot can cause trouble. Usually all she has to do is make a run to the nearest supermarket or drug store for a new cord or wall receptacle. Aircrews in flight have a slightly different problem—there's no supermarket half a block away. A B-52 crew discovered this when suddenly the radar, pilot's attitude indicator, transponder, N-1 compass, fuel gages, cabin temp control and seat positioning switches became inoperative.

The report went on to say that the navigator investigated and found six blown fuses in the circuit breaker panel. After they were replaced with no results the aircraft aborted the mission and landed. The trouble was in the hot cup used to heat coffee. It had an internal short.

To prevent this sort of thing happening again, this unit has installed a checkout panel in the inflight kitchen where hot cups can be tested prior to use. A recommendation was that all organizations using these hot cups provide similar equipment. Sounds like a good idea. ★

FALLOUT

continued from inside front cover

Granted, many recips are considerably more complicated than the old T-Bird system-wise. But I think our friend would have his hands full today being completely up to date and capable of handling any situation in the F-106, F-4 or the F-111 with their standard aircraft, navigation and weapon systems.

Having been privileged to serve an exchange tour with the Air Force for two and a half years, the professionalism I have seen displayed in no way harked back to the scarf in the breeze days. Thoroughly trained, highly knowledgeable, and skillfully qualified are the rule in the fighter types I have been associated with, rather than the exception.

Also, the days of shouting as instruction are over, in fighters in the Navy and Air Force. I have instructed fighters in both. The fellow who feathered Nr 1 when Nr 2 has failed is the same guy who shuts down the starboard engine when the port has the fire, but the rate at which the resulting things happen is considerably faster than in the recips.

The student in the T-38 climbing to 40M in three minutes is considerably more pressed—reaction time and thinking-wise—than the student making 1500 fpm up in the recip.

The main point I am trying to make is that, in general, a high performance jet requires faster thought processes and reaction times than are required in recips. Having been heavily involved in transitioning multi-engine pilots to fighters, it was obvious that the talent was there but for a period of time, depending upon the individual involved, the thinking was 'way behind the aircraft.

Things happen a little faster when an F-104 flames out on initial versus a recip quitting at the same time. The time to react goes down in orders of magnitude for the silver dart jock. Things happen a little faster with an F-104 on ILS final at 175 KIAS vs. 120 for the ol' recip. And the recip jock in the lower part of the thunderstorm is no worse off than the fighter jock flamed out in the top of it due to ice and turbulence. Smoothly getting the passengers down in a recip requires no more skill than bringing a flight of four fighters home in good shape.

Among the fighter pilots I have known in the Air Force, if they wore the top button open, it was because they took pride in being able to quickly, professionally, and skillfully handle any situation presented to them.

My hat's off to the recip boys if they were able to instill that attitude in the author. Professionalism is the goal in all flight—recip, helo, jet, and I believe that's what we're all shooting for, so let's stop pumping up one branch at the expense of knocking the other.

J. L. Finley, Lt USN
USAF Aerospace Rsch Plt Schoo
Edwards AFB, California

As expected, this letter really stirred u the fighter troops. But not one letter fron the recip drivers. Space doesn't permit run ning all the letters, but Lt Finley's is rep resentative of the many received. It is evi dent why the author refused permission t use his byline. Until a few months ago h was a fighter pilot—P-51, F-84, F-86, F-10 —and served in Europe and in the Fa East, as well as in the U.S. According t him, he had been talking the recip pilot down for so many years that he wa amazed that they could actually fly. He wa so amazed that he wanted to tell the worl about it without having his old friend writing him nasty letters.

As Lt Finley points out, professionalism is the goal no matter what type of aircraf a pilot flies. We know our fighter pilots ar the finest in the world, and we have th same opinion of those who fly the "Ol Shakeys," the "Dollar Nineteens" and th rest of our cargo-transport aircraft. And w liked the spirit expressed by the fighte pilots who wrote to take the "deserter fron their ranks" down a peg.

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 201-218/1

# WELL DONE

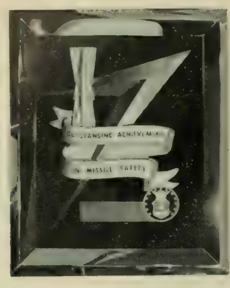
CAPTAIN JAMES D. JOHNSON

4510 COMBAT CREW TRAINING WING, LUKE AFB, ARIZONA

Captain Johnson was number three in a four-ship F-100 student training mission in the Gila Bend Gunnery Complex. After recovering from a VLADD maneuver, Captain Johnson, a recent basic flying school graduate with only 29 hours of F-100 time, was unable to bring the throttle of his F-100D inboard out of afterburner or retard the throttle below minimum afterburner range. He notified his flight leader and proceeded directly to the closest emergency field 30 NM away. Fuel indications at this time were 4300 pounds total and 1400 pounds in the forward tank. Minimum engine RPM attainable was 85 per cent. Fuel consumption in afterburner at this power setting and altitude was such that Captain Johnson had to plan his pattern and landing precisely.

Captain Johnson extended speed brakes as he approached the emergency landing field and attempted to slow his aircraft to below landing gear limit speed. He was not able to decrease airspeed below 310 KIAS in level flight as he passed abeam the departure end of the runway at normal downwind pattern altitude. Captain Johnson raised the nose and zoomed the aircraft up to approximately 500 feet AGL to obtain gear lowering speed. He decided he would have to fly a modified precautionary landing pattern to make the field. Captain Johnson had been briefed on this pattern, but had never had it demonstrated to him nor had he flown this type of landing pattern previously. Landing gear and flaps were lowered at the low key point, and the pattern was continued. Base leg and final approach airspeeds were controlled by use of speed brakes. During the flare over the runway overrun, Captain Johnson shut off fuel to the engine by turning off the Engine Master Switch. Touchdown was accomplished within the first 1000 feet of the 8500-foot runway, and the drag chute was deployed. Engine RPM did not start to decrease until there was approximately 4500 feet of runway remaining, but Captain Johnson was able to stop his aircraft on the runway with no difficulty.

Captain Johnson demonstrated outstanding airmanship and skill while handling this inflight emergency. WELL DONE! ★



MISSILE SAFETY AWARDS

The following units have been selected to receive Missile Safety Awards for calendar year 1965.

ADC	456 Fighter Interceptor Squadron Castle AFB, California 10 Aerospace Defense Squadron Vandenberg AFB, California
AFSC	6595 Aerospace Test Wing Vandenberg AFB, California 6555 Aerospace Test Wing Patrick AFB, Florida
PACAF	39 Air Division Misawa AB, Japan 18 Tactical Fighter Wing Kadena AB, Okinawa
SAC	455 Strategic Missile Wing Minot AFB, North Dakota 465 Bombardment Wing Robins AFB, Georgia
TAC	4510 Combat Crew Training Wing Luke AFB, Arizona 4520 Combat Crew Training Wing Nellis AFB, Nevada
USAFE	36 Tactical Fighter Wing Bitburg AB, Germany
ANG	147 Fighter Group Ellington AFB, Texas

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AEROSPACE
SAFETY
UNITED STATES AIR FORCE

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OVERHEAT WARNING
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DRAG CHUTES
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CROSSWIND LANDINGS
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AEROSPACE SAFETY

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Major General William B. Campbell	Deputy Inspector General for Inspection and Safety, USAF
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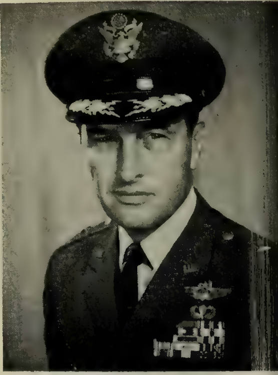


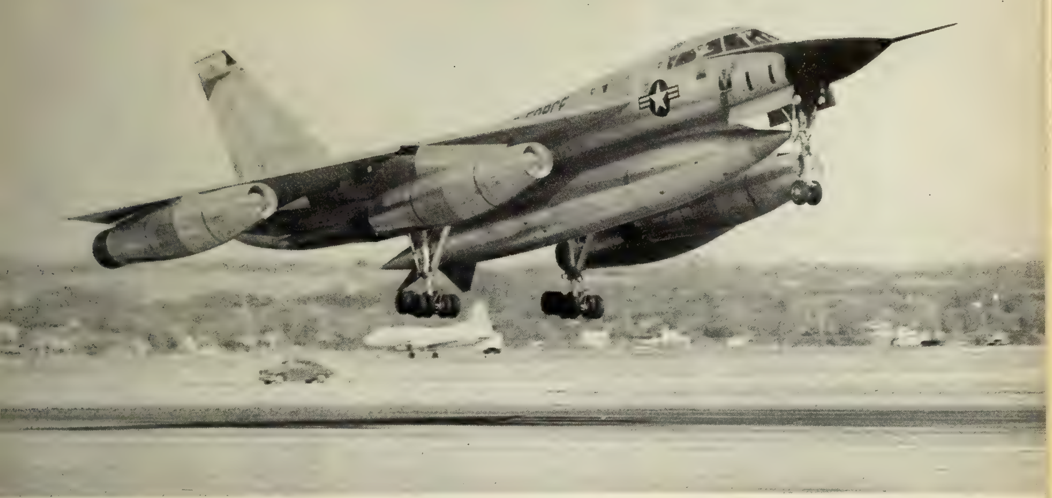
Brigadier General Frank K. Evere Jr., has been assigned Director of Aer space Safety. A fighter pilot in Wor War II, General Everest is best known a test pilot. In addition to testing mo of the Century Series fighters, and se eral bombers, he flew the early expe mental rocket-powered aircraft includi the X-2 in which he set an unoffic speed record of 1957 mph, or 2.9 Ma

During World War II, General Evere served in North Africa and Italy whe he shot down two German aircraft. Af returning to the United States, he structed in fighters for several mont then was assigned to the Chinese Thea where he flew 67 combat missions a destroyed four Japanese aircraft. In M 1945 his aircraft was shot down a General Everest was imprisoned u the end of hostilities. After the wa began testing aircraft at Wright-P terson AFB and later Edwards AFB w he became chief of the Flight Test Op ations Division.

General Everest succeeds Brigad General C. B. Stewart, who retires July after a distinguished career as Air Force pilot, nuclear physicist and Air Force's first Director of Nucl Safety.

In assuming direction of the wo wide Air Force safety effort, Gene Everest will be responsible for the c duct of accident prevention and inve gation programs in the aircraft, miss ground, and explosives safety fields.

Modified Precision Approach...



THE GREATEST THING SINCE THE WHEEL

Capt Clyde M. Slade
Hq Central Communications Region (AFCS)
Tinker AFB, Oklahoma

The IFR supplement has a notation for Little Rock and Bunker Hill AFBs which reads: "Modified PAR (MPAR) for B-58 type aircraft may be in operation. Other aircraft expect slight delay for PAR approach." Modified Precision Approach is more than just another attempt to solve an old problem. Its revolutionary concepts offer a breakthrough which may actually be the answer to high performance aircraft landing problems, while also benefiting conventional aircraft.

Historically, the average radar precision approach (PAR) system is configured with a 2½ degree glide path angle which intersects the runway at a distance of 750 to 1000 feet down the runway from the threshold. This point where, in theory, the aircraft should touch down is known as glide path intercept point (GPIP). If this theory held up in actual practice, we could have true zero zero landing capability by simply flying the aircraft right onto the runway at a 2½-degree descent angle. However, with the notable exception of the F-4C, contacting the runway with this rate of descent (575 to 880 feet per minute) exceeds maximum sink rate at touchdown for most normal gross landing weights. Thus, a pilot cannot fly onto the runway at GPIP, but must flare to reduce sink rate and bring his aircraft within allowable load limits for touchdown.

This then is the problem. As approach speeds increase, flare distance increases until in B-58, F-105 types, it exceeds a horizontal distance of 4000 feet. Where flare distance plus stopping distance exceeds available runway length, the results will be obvious. To try and beat this problem, the pilot descends below the glide path farther out on final to reach flare height sooner which in turn allows him to complete his flare and touch down closer to the runway threshold. This "duck under" maneuver is

THE GREATEST THING SINCE THE WHEEL

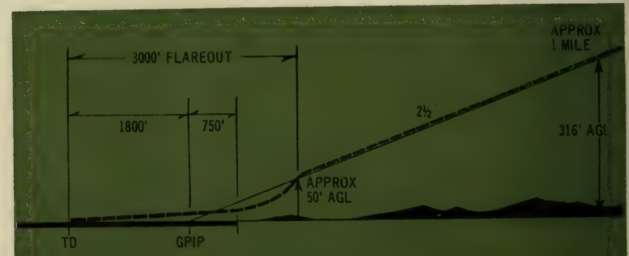
CONTINUED

easily recognized by a radar air traffic controller. At a point near one mile on final approach, the high performance aircraft will predictably go well below glide path (if in visual contact with the runway) and does not respond to instructions to "adjust rate of descent" to return to the glide path. In many cases, the controller must transmit, "If runway not in sight, climb immediately," because the aircraft has exceeded the lower safety zone limit on the radar indicator.

This has become an exercise in frustration for both parties. The pilot is where he wants to be, the controller knows the pilot is now in visual contact with the runway, yet he must alert the pilot that he does not have IFR obstruction clearance margin. This "duck under" maneuver sets up very high vertical energy from steepened angle of descent. The old physics law "for every action there must be a reaction" applies here and compensating for increased rates of descent on the order of 1300 feet per minute can get pretty sticky on short final. Failure to recognize the need for increased power requirements which have a high onset rate while the aircraft approaches the back side of the power curve, has had the unhappy result of transferring the accident from the departure end to the approach end. Obviously, improvement in the system is needed.

FAA, SAC and Central Communications Region of AFCS participated in tests to learn as much as possible about B-58 landing problems. Many theories were checked, including different glide path angles. Out of these exhaustive tests, came a proposal which may one day soon provide pilots of high performance aircraft with a safer instrument approach landing environment. Previous attempts to overcome the problem all stayed within the confines of the time honored classical precision approach, and simply relocated the GPIP closer to or at runway threshold. As envisioned by SAC and Central Comm Rgn ATC experts, the solution was to reconfigure the glide path to bring the aircraft to a point on final to coincide with the height at which the pilot would want to be if he were making a visual approach. Upon arrival at this point, the pilot should be assured of being in visual contact with the runway. From here, it's a simple matter to make a normal visual landing.

The theory of splitting the precision approach into IFR and VFR portions was tested at Little Rock AFB in Aug 1965 by B-58s of the 43d and 305th Bombardment Wings. Results were startling. Touchdowns within the first 2000 feet of runway increased 100 per cent. Over 95 per cent of the participating pilots used superlatives in favoring the new procedure. So convincing was the Little Rock test that SAC asked for and received USAF approval to place



NORMAL PAR

High performance aircraft maintaining on glide path until reaching flare height touches down approximately 2550 feet down runway. Note greatly increased angle of descent (duck under maneuver).

the MPAR into operational use for B-58s.

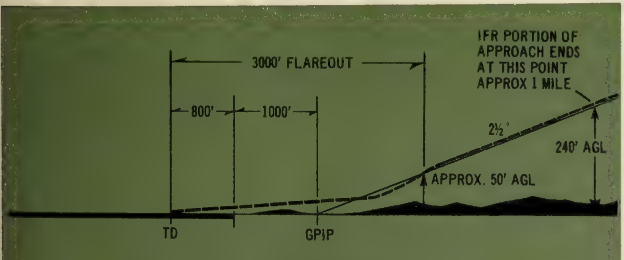
What then exactly is this MPAR animal? MPAR as finally implemented for operational use on 15 Feb 1966, can best be described by a comparison with the normal procedure. PAR GPIP is normally located 750 to 1000 feet inward from the runway threshold. MPAR GPIP is relocated up to 1000 feet *outward* from the runway threshold. The operational configuration at Little Rock and Bunker Hill has GPIP 1000 feet short of the instrument runway, but only 500 feet short on the reciprocal runway. While the 1000 feet displacement was tailored to the B-58s high approach speed, 500 feet also works well and has wider application at airfields with terrain clearance problems as well as for aircraft with slower final approach speeds.

Normal PAR minimum altitude is tied in with the ceiling minimums. For example, if 300-1 minimums were established, the precision minimum altitude would be 300 feet. With MPAR, minimum altitude for this ceiling is 240 feet. This is necessary to insure a clear-of-clouds condition, since whenever the cloud base is between 250-349 feet, the weather man calls it a 300-foot ceiling. This 240 feet minimum altitude becomes the key to the procedure. At 240 feet above runway elevation the instrument approach terminates and so do controller instructions. Because GPIP is well short of the runway, IFR obstruction clearance is possible only to precision minimum altitude. Here's where we pick up the benefits not possible with previous attempts to solve the problem.

The radar controller directs the pilot to a point in space where the pilot would position himself if flying visually. He's 240 feet above the runway approximately one mile out, whereas the normal procedure would have him 316 feet above the airport. The 76 feet gained by the MPAR reduces the "duck under" maneuver to a normal landing flare. The pilot is assured that the radar controller has placed him in a position from where he can see the runway (unless the reported weather has deteriorated while on approach). Then, the controller simply shuts up and lets the pilot concentrate on the business at hand—landing his aircraft. No more "if runway not in sight . . ." during that last mile on final. The pilot also has, for the first time, an opportunity to fly with some pretty realistic minimums. Where previously, some intrepid birdmen had "personal" minimums because they knew the cloud base might be slightly lower when reported as 300 feet, there was a tendency to "feel" a little, hoping to break out. Now with MPAR, if not in visual conditions when the radar controller says "Precision Minimum Altitude, take over visually," an immediate missed approach is the order of the day. Continuing established rate of descent on the glide path below 240 feet will bring contact with the ground well short of the runway, on the order of 10 seconds later.

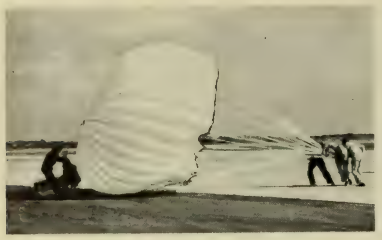
The MPAR concept as applied to the B-58 works well. That it may also apply to other type aircraft is evidenced by a USAFE study on GPIP placement in July 1964 which stated "If we really wanted to position the pilot where he wants to be when he breaks out, we should site our GPIPs about 800 feet before threshold on 8000-foot runways!" It is significant that the USAFE study was not known to the B-58 group. Apparently all roads lead to the MPAR, a theory which has been proven in operational use for at least one type of aircraft.

MPARs are presently authorized for B-58s only, so don't go charging off to Little Rock or Bunker Hill hoping to try one on for size. SAC's operational experience with MPAR holds out much promise, though. The procedure has been flown by C-123, T-39 and KC-135 with good pilot comments. KC-135s will soon test the procedure for potential operational use. If it proves adaptable for the slower tankers, then I predict it will gain rapid acceptance until the day will come when PAR, as you now know it, will be remembered with the Adcock Range as a primitive instrument approach aid. It may not be the greatest thing since the wheel, but it's a big help in getting those wheels on the concrete at the right place. ★



MPAR

High performance aircraft flies visually from 240 feet minimum altitude. Starts flare farther out at same height and touches down approximately 800 feet down runway. Duck under maneuver is eliminated.



DRAG CHUTES

Six hundred and fifty-five drag chute failures seem like a lot. That was the number of such occurrences reported last year. But as is frequently the case with numbers, this number – 655 – doesn't mean a thing without some more information.

First, there were about 896,000 landings by drag chute equipped aircraft, so a mere 655 drag chutes that didn't work would seem to indicate that we are doing quite well. But reporting of drag chute failures is not required by AFR 127-4; reporting is more or less up to the commands, therefore reporting policy is not uniform. Undoubtedly, the number of failures is higher than that reported. But assuming the number is somewhere in the ballpark, does it indicate a serious problem? We're going to be ambivalent and satisfy everybody. The answer is yes and no. No, because the percentage of failures is only a fraction of one. Yes. because a drag chute failure might mean an accident and has on several occasions.

As for accidents, we measure how we're doing by a rate, which is simply the number of accidents per 100,000 hours of flying. If we were to take the number of accidents as a percentage of the number of flights, or sorties, what would it be? There's no way of knowing, but obviously it would be a very small per cent. Even so, we consider every accident as serious. So let's think of drag chute failures as potential accidents and treat them with the concern they deserve.

Perhaps the experience of one organization is indicative of the size of the problem. Over a two-months period, drag chutes failed only about .02 per cent of the time. But *one-third* of all incidents were drag chute failures.

A review of the 655 failures reported Air Force-wide in 1965 shows that nearly half were caused by Maintenance; Materiel Failure took care of most of the other half, and pilots bought only 16. The two aircraft most associated with these incidents were the F-100 (286) and the F-105 (152).

Here are a few narratives, typical of the reports received:

- F-100D, pilot chute deployed but main chute pack hung up on bent door hinge of container.
- F-101A, pilot could not pull drag chute handle. Drag chute D-ring improperly installed, jamming drag chute door release mechanism.
- F-100D, drag chute failed to deploy. Bridle pin installed backwards.
- F-102A, drag chute fell from aircraft when pilot pulled handle. D-ring not properly secured in clamps.
- F-101A, as afterburner lit on takeoff roll, the drag chute fell out of aircraft. Drag chute door latch worn and out of adjustment.
- F-102A, drag chute failed to deploy. Ripcord spring weak. Ripcord pin could not be pulled for pilot chute cone because improper size bolt installed.
- F-102A (two the same day), drag chute remained in aircraft when handle pulled. Aircraft left outside overnight with drag chute installed and condensation froze.
- F-100D, drag chute handle could not be pulled out because horizontal and vertical cables kinked and rusted.

Successful landing with drag chute doing its job. When it doesn't, the pilot may face the barrier, or a trip off the end.

- F-105D, part of pilot chute forward of drag chute bag and pinned in by bag and striker plate.

A recent report states that the ripcord pin on an F-102 drag chute was safety wired which prevented chute deployment. And the pilot chute pocket flaps on an F-100 were secured with a cotter key instead of a ground safety pin with streamer. When the drag chute doors were opened, the pilot chute could not be deployed to pull the compartment liner door pin that would deploy the drag chute.

In North American's Operation and Service News for December 1965 there was a write-up on two F-100 outfits and how they went about solving their drag chute problems. Although different systems have somewhat different problems, we think the item is worth passing on to all drag chute users.

- "To date this month, 1891 hours were flown without a drag chute failure. We attribute the lack of drag chute problems to the maintenance system that is being followed here. The most important part of the system is that a group of drag chute system specialists maintain the system. They do all the work from packing and installing the drag chute to inspecting and checking the system for rigging and adjustments when the airplanes are in the dock after periodic inspection. We believe another preventive maintenance procedure that is worthwhile is changing the horizontal teleflex cable at each 100-hour postflight inspection: both the horizontal and vertical cables are changed at every periodic inspection.

"This system has been in operation about three months and since its initiation, there has been a steady decrease in drag chute failures."

* * *

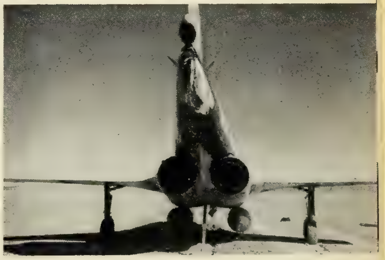
- "Drag chute system maintenance is divided into three general categories; routine servicing after each deployment, scheduled inspections, and unscheduled maintenance. Servicing after each deployment is accomplished by our crew chiefs, each of whom has been carefully schooled in drag chute installation procedures. Prior to installation of a drag chute, each crew chief must "set" the system and make a ground check, pulling the drag chute handle to "deploy" and to "jettison." Only after this check has been successfully accomplished, is the replacement chute installed. It is our policy that after each deployment, a Red Cross will be entered on AFTO Form 781A for the affected aircraft. After installation of a serviceable chute by the crew chief, a supervisory member of the team must inspect the installation and clear the Red Cross. This system of double checking assures that each drag chute is properly installed and the system is in rig prior to release for flight.

"During each periodic inspection, every drag chute system is completely disassembled and all components cleaned and checked prior to reinstallation. Marginal components are either repaired or replaced so that the system is returned to a 'like new' configuration upon completion. In addition, the aft section horizontal and vertical Teleflex cables are removed each 100 hours, the conduits and cables cleaned, the cables reinstalled, the system rigged and then checked for correct operation and proper drag chute handle loads. During each 50-hour postflight inspection, the system is again checked for correct operation and proper drag chute handle loads. Teleflex conduits are cleaned exclusively with an S/N AO37-71-62702, .50 cal. cleaning brush welded to a condemned Teleflex cable. Solvent, PS-661, is the only liquid authorized for cleaning of components of this system. Our procedures strictly forbid the use of lubricants of any kind on Teleflex conduits and cables and in the Teleflex control boxes.

"The third step in our procedure is to thoroughly investigate each drag chute system failure so that the cause factor can be determined and the necessary corrective action taken. For this reason, we have developed a *"Drag Chute Failure Report"* form which is completed by the team following investigation of each drag chute system failure.

"Another reason for our successful operation is in our drag chute packing procedures. All drag chutes are inspected and packed by specialists who pay particular attention to the condition of all components comprising the basic drag chute. These carefully packed assemblies are the only ones used —packing by other personnel is not authorized. It is our policy that on cross-country trips to other bases, spare drag chutes from our station will be carried in the aircraft for installation at each station. The foregoing procedures have contributed largely to our drag chute system reliability. Detailed training and job specialization have made it possible for us to accomplish all of the special maintenance procedures with a minimum manhour expenditure."

What happens when a drag chute fails? This F-101 missed the barrier, went off the end during test at Edwards. Not many bases have lake beds for overrun.



These two statements indicate that drag chute problems, like any other problem, can be solved. And we are solving them; the small number of failures indicates this. But as long as we have any failures there will be pilots who won't feel that comforting tug when they need it most. ★

F-100
APPROACH END ARRESTMENT

The flight was a Stan/Eval check ride for Captain Paul Phillips who was completing Instructor Pilot upgrading in the F-100. The air-to-ground mission was briefed by Captain Phillips who had to lead the flight from the rear cockpit as part of his Stan/Eval check ride. The three wingmen who completed the flight would strafe, dive bomb and fire rockets.

The mission was uneventful up to the landing pattern. On the first pattern, for a touch and go landing, the left main gear of Captains Bell and Phillips' aircraft would not extend. Mobile was called to confirm the position of the left main gear. It was confirmed up and the right main and nose gear were down. An attempt was made to raise the landing gear, but it would not respond. The emergency extension was attempted next with no effect. G's were applied to the aircraft and still no effect.

A visual inflight check was accomplished by Captain Doug Henderson, another F-100 IP assigned to the 4517 CCTS. He also confirmed that the right and nose gear were down. The left main gear was up and the door was partially open and appeared to be hanging. All available means to get the left gear down were tried, but to no avail, nor would the right main or nose gear retract.

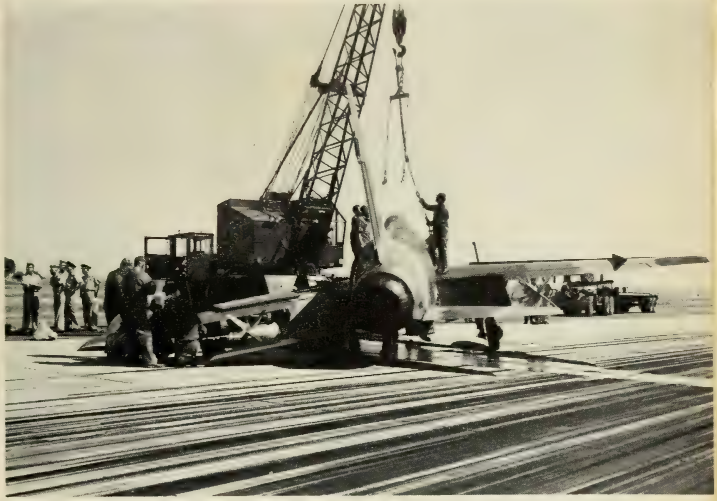
Three possible decisions were considered on how to recover the aircraft: Number one, ejection; number two, belly the aircraft in on the gear that was available; and number three, an approach end arrestment which was recently publicized in TAC Attack, TAC's safety magazine. The idea of ejecting did not appeal to either pilot. It would also result in the loss of the aircraft. Captain Bell had observed two other F-100s land with partial gear and he didn't want to attempt this sort of landing because, from his personal observation, it had not been too successful. About this time mobile control called and asked if an approach end arrestment was going to be made. Captain Bell decided that this was the best course of action because the IP sitting in mobile had also considered the same alternatives. An affirmative was radioed to mobile that an approach end arrestment would be made. (Captain Bell later found out that the assistant mobile control officer had also read the flying safety article on approach end arrestment. He was a Marine captain assigned to the F-104 program at Luke AFB and had suggested this alternative to the senior mobile control officer and supervisor of flying, Major Hannaman of the 4514 CCTS.)

The aircraft had pylon tanks and MA-2 rocket launchers installed. The decision was made to retain these for an approach end arrestment so as to cushion the impact and minimize the aircraft damage. The position of the rocket rails on the outboard station bothered Captain Bell. He feared the wing might drop prior to reaching the cable and allow the rocket rails to hook and produce a severe, if not fatal, ground loop. Fuel was burned down to 1000 lbs by this time and enough would be available for a go-around if the first engagement was not successful. Captain Phillips, in the rear cockpit, was in complete agreement with the decisions that had been made.

Captain Bell decided to make a minimum airspeed approach over the overrun so he could drag the hook on the ground prior to touchdown but still retain enough air-

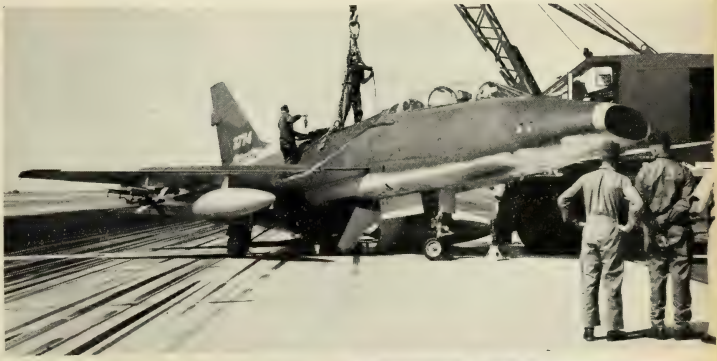
(This account of an emergency in hich one of the main landing ears could not be extended was ontributed by the Safety Office at uke AFB. It is a blow-by-blow escription furnished by Captain . P. Bell, who occupied the front eat of the aircraft. Ed.)

ight, cushions and an airbag nder the left wing prevent urther damage to aircraft.→

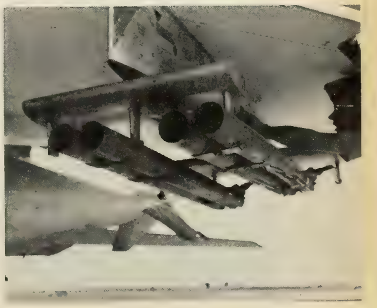


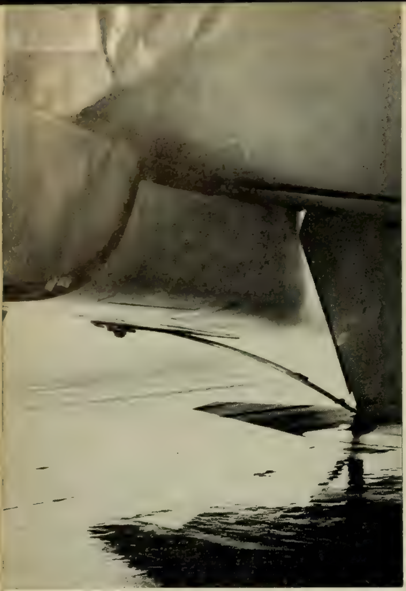
speed to fully control the aircraft until a positive engagement was made. In case the first attempt was missed, a go-around would be initiated. The following landing configuration was selected: The speed brakes and full flaps were selected for two reasons. The speed brakes would stabilize the aircraft and allow a higher engine RPM and thrust available to aid in an immediate go-around if it became necessary. Secondly, they might help cushion the shock in the event of a sheared gear following hook engagement and deceleration.

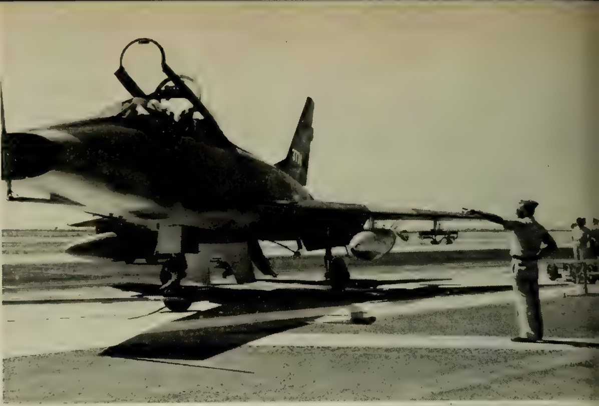
Mobile control had alerted the crash network; fire trucks, ambulance, rescue helicopter, and the Wing Commander were standing by. The MA-1A had been disconnected to prevent an inadvertent engagement of that barrier. The time from the initial trouble until touchdown was approximately ten minutes. The fire trucks had approximately three minutes prior notification so the runway was not foamed. Captain Bell did not feel that foam was a good idea, since hydraulic pressure was available and directional control could possibly be aided and maintained by



Above picture shows amount of angle off from center of runway. The maintenance people first hooked onto the aircraft very carefully in order to lift it high enough to get a jack under the left wing. Most of this turning took place just prior to aircraft's coming to complete stop after the wing dropped to the ground.
Right, close-up of the MA-2 launcher rail shows the small amount of damage to the outboard tubes. →







▲Reclamation officer directs aircraft be towed off the runway approximately 45 minutes after the landing. Estimated repair time was 20 direct manhours. The left tank had to be replaced, the left rocket launcher replaced, and a small amount of sheet metal repair to the tail hookup locking bracket fitting area.

◀ Photo of the left wing shows position of the gear as it was in flight. Note the left flap is full down and unscathed. Fluid on the ground is water from the fire trucks that washed away fuel to prevent fire hazard.

braking and nose wheel steering on a dry runway.

A two-mile straight in final approach was made, starting at about 170 knots and maintaining the descent with power. The aircraft was allowed to descend very slowly until the hook made contact with the overrun about 300-400 feet from the cable. Mobile control aided at this time by suggesting, "ease it down." Hook contact with the ground could definitely be felt and heard by both pilots in the cockpit and the aircraft was decelerating for a planned touchdown at or just past the end of the runway where the barrier is located at Luke AFB. This plan would prevent the wing from dropping prior to passing the barrier.

The aircraft touched down shortly after hook engagement. Airspeed at engagement was between 145-150. Observers said the right main gear was about two inches off the runway when the tail hook engaged the barrier. The nose gear came down smoothly on engagement. The deceleration was rapid and steady. Mild jerks throughout the entire deceleration were noticeable, but not violent. This was probably caused by the braking of the BAK-9 system. The aircraft started a mild left drift immediately after engagement. Right brake was applied and nose gear steering was used as an automatic reaction. The left wing did not contact the ground until shortly before the aircraft stopped. This was verified by the mobile control officer.

The engine was shut down about the time the aircraft came to a complete stop. Throughout the approach good positive lateral control was maintained over the aircraft with the configuration that had been selected. The deceleration of the BAK-9 was so rapid that Captain Bell did not have time to stopcock the engine prior to stopping. At hook engagement the throttle started forward and it took a positive effort to retard the throttle to idle because of these deceleration forces.

The MA-2 rocket launcher and the left 275-gallon drop tank acted as cushions and prevented the left wing tip and speed brakes from touching the ground. The aircraft was raised with a crane, left gear extended, safetied, and towed off the runway. The cause was determined to be a missing bolt.

Captain Bell suggests no firm procedure be formulated that would prevent a pilot from using a little personal judgment, because there are so many varied emergencies that no one procedure can be devised to cover them all. He feels it would be worthwhile to caution pilots about possible loss of aircraft control if touchdown is made prior to the barrier *without all* gear extended. When the three gear are in the extended position, and there is no fear of directional control loss prior to barrier engagement, the touchdown as recommended in the Dash One (400-500 feet short of the barrier) would be the best procedure for an approach end arrestment.

The crew added that prompt action by the mobile control officer and his assistant, and the response of reserve personnel were sincerely appreciated. ★

F-4 TIRES

Since publication of the article "The F-4 and a Wet Runway" in the June issue of AEROSPACE SAFETY, several queries have been received relative to the new tires for the F-4.

The article said that the old three-groove tire would be used stateside but that all overseas supply requests would be filled with the four-groove tire.

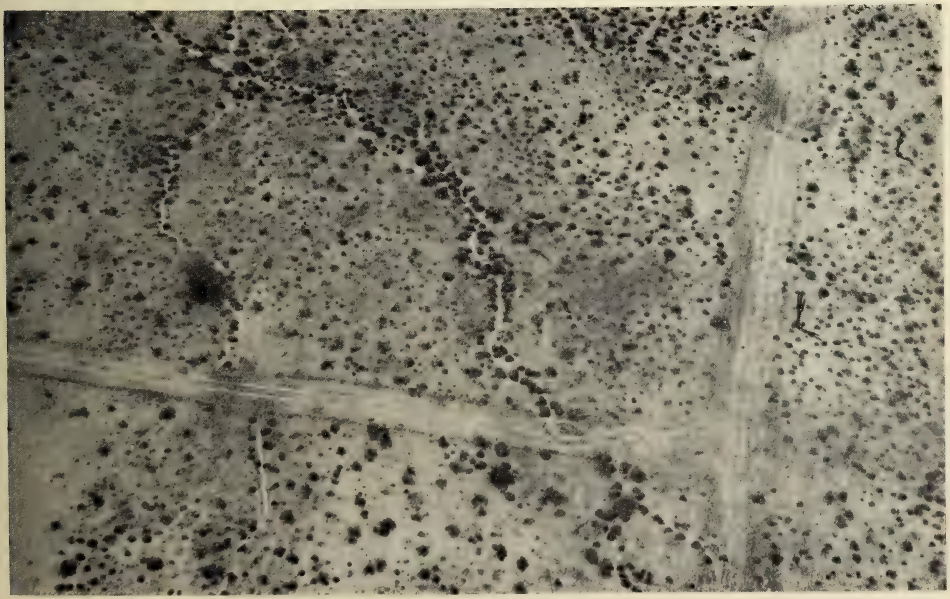
This has been changed and here's the latest chapter in the F-4 tire story: All orders will be filled with tires of the latest groove design, and they may have been built by any one of several manufacturers. Although the Goodrich tires appear to have narrow grooves when not inflated, the grooves are actually wider than those on the *old* three-groove tires. The uninflated groove widths for the new Goodrich tire are: center groove ¼ inch, outside grooves ⅜ inch. When the tire is inflated and up to speed these grooves open to ⅜ and ½ inch. This is in contrast to the old three-groove tire which had ¼ inch grooves.

There is no way of identifying the wide three-groove Goodrich tire by stock number. But any Goodrich tire stamped with date of manufacture after October 1965 will be the new wide groove design.

The important thing is that the tires supplied meet specifications regardless of the number of grooves or the name of the manufacturer. ★

DOWNED PILOT:

This photograph was taken from an H-43 at 500 feet during search for a pilot on the ground. Can you locate the pilot? If not, turn to page 18.

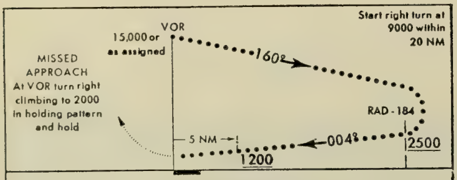


THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Q (Refer to the diagram below.) How do I know when I am five miles from the VOR?

A Numerous VOR and ADF approaches are published with altitude/distance restrictions after completing the penetration turn. All of them have one thing in common—it is extremely difficult to determine your distance from the facility when inbound. Therefore select another approach, if one is available. If you were forced to perform the above approach, you should consider average TAS outbound, penetration turn radius, average TAS inbound and wind effect. Begin descent from 1200 feet to minimum altitude based on your estimate of position.


VOR
15,000 or as assigned
Start right turn at 9000 within 20 NM
160°
MISSED APPROACH At VOR turn right climbing to 2000 in holding pattern and hold
RAD - 184
5 NM
004°
2500
1200

LANDING MINIMA

Straight - In Rwy 1R	NOT	AUTHORIZED	
Circling	675 MSL	600-1	

VOR

Q Some high altitude teardrop penetration procedures state: "Start right turn at half initial altitude." Does this mean half the published initial penetration altitude or half the altitude to be lost?

A Half the altitude to be lost. An easy method for determining this is to add the penetration altitude to the level-off altitude. Divide the sum by two and you have the penetration turn altitude. For example, penetration started at FL 200 with a "complete penetration turn" altitude of 3000. FL 200 plus 3000 equals 23,000 divided by two, results in 11,500 turn altitude.

Q Are the cruising altitude diagrams depicted in FLIP II (U.S.) based on magnetic heading or magnetic course?

A Magnetic course. For example, an aircraft VFR below FL 180 flying a course of 355 degrees and maintaining a heading of 005 degrees would select an even thousand plus 500 feet. For aircraft not flying a course, the pilot should select an altitude based on aircraft heading.

TRY THIS QUIZ

1. Radar traffic information is routinely provided to aircraft operating on IFR flight plans except:

a. When the pilot advises he does not desire the service.

b. When operating within positive controlled airspace.

c. When inflight visibility is less than three miles.

d. Both a and b above.

2. Radar traffic information is provided to aircraft *not* operating on IFR flight plans:

a. Normally, only when the pilot requests it.

b. Only in certain terminal areas where high density traffic makes the issuance of traffic information desirable.

c. Radar traffic information is provided only to aircraft on IFR flight plans.

3. True or False. Radar traffic controllers will normally provide an aircraft receiving traffic information with vectors to avoid uncontrolled observed traffic *only when the pilot requests it.*
ANSWERS: 1, d; 2, a; 3, True.

POINT TO PONDER

Deviated around any thunderstorms lately? AFM 105-5, Weather for Aircrews, Change B, 20 January 1966, states:

"Thus hail may be encountered not only in the thunderstorm itself but also (1) in the clear air six to eight miles on the windward side of the storm, (2) five to fifteen miles on the downwind side of the storm (depending on the winds aloft), and (3) underneath the overhanging anvil clouds. The only safe procedure is to give every thunderstorm a wide berth. . . ." ★

F-100 Hot Weather Operation

NAA Operation and Service News

No matter how well an airplane is designed, its degree of efficient operation is commensurate with the type of maintenance it receives. The systems and components of the Century Birds are designed to operate within a temperature range of −65°F to +160°F. Since the hot weather season is with us, let's consider some of the precautions necessary to ensure maximum utilization of the F-100 airplanes during this period.

CANOPY AND COCKPIT TEMPERATURE

The canopy will withstand temperatures up to 200°F without distortion. However, certain precautions should be taken in accordance with the following:

- When sand or dust is blowing the canopy should be covered for protection.
- The canopy should never be left closed when temperatures are above 100°F.
- When the temperature is above 120°F, the canopy must be open and the cockpit should be shaded from the direct rays of the sun, if possible.

NOTE

Rain entering the cockpit may damage the many electrical and mechanical components. Ensure that canopy is fully closed during wet climatic conditions.

TIRES

- Pressure of tires should be checked daily.
- During extreme hot weather, when possible, tires should be checked early in the morning or late in the evening, when the temperature is nearest 70°F.
- Tires should be checked for blisters after each flight. When blisters or damage to tire is severe enough to be dangerous to personnel, release air in tire before removing the wheel from the airplane.

CABLE TENSIONS

Cable tensions vary considerably at different temperatures. It is not unusual for temperatures to vary 30°F in a 24-hour period. Therefore, it is very important that temperatures be taken into consideration during rigging and tension checking procedures.

- Rig the airplane in the hangar or in the shade.
- Allow the airplane to remain in a constant temperature area as long as possible before rigging, to stabilize the temperature within the structure.
- Tension readings given in the F-100 Systems Maintenance Manuals are based on a temperature of 70°F and must be used in conjunction with a cable tension variation chart. Take temperature reading inside of nose wheel well.
- Do not rig to the extreme of any tolerance, but always as close to the center of tolerance as possible.
- If it is necessary to rig the airplane in the sun, point the airplane either directly into or away from the sun. (This is to allow the wings to heat evenly from solar radiation.) In addition, set the tensiometer for a cable tension equivalent to a temperature 5°F above wheel well readings to compensate for solar radiation. ★

The anti-exposure suit is a life-saver in the environment for which it was designed. It was not made for pacing the ramp on hot days.

OVERHEAT WARNING

Lt Col W. C. Kaufman, USAF, and A. C. Brown, Ph.D.
Aerospace Medical Research Laboratory (AFSC)

A routine gunnery mission in a jet fighter may seem far removed from space flight, but the man in each vehicle is the same. He does not become a superman simply because he climbs aboard a supervehicle. His limitations remain the same and may even be accentuated when he experiences the increased stresses associated with space exploration.

One of the most serious of the problems anticipated in the exploration of space is that of protecting man from the temperature extremes he will encounter during extravehicular activity. Fundamental to the solution of this problem is the development of a space garment that will provide him with his own little air conditioned environment while he may be exposed to the radiant heat of the 10,000-degree surface of the sun on one side and the cold of absolute zero of black space on the other. Such a suit is quite like the antiexposure suit worn routinely on overwater flights in fighter aircraft. Each garment must be provided with its own air conditioning system in order to function properly. Without air conditioning each can become a sort of pressure cooker in which the occupant may parboil due to his own metabolic heat production.

Several years ago the Biothermal Branch, Aerospace Medical Research Laboratory, began a program with the University of Washington's Department of Physiology and Biophysics to develop an electronic analog of man's temperature regulating mechanism. With this device it is now possible to predict with reasonable precision human response to any thermal stress. It will be particularly valuable in determining man's relationship to his temperature environment in space, an environment which cannot be readily simulated. With it we can also learn man's responses to thermal stresses too dangerous for experimentation.

The first practical problem for the biothermal analog arose recently as the result of an incident that occurred on an east coast fighter base.

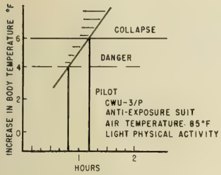
A pilot who was to fly a gunnery mission reported to his aircraft dressed in the usual anti-immersion garb because the range was over the ocean. After he entered the cockpit, a minor mechanical difficulty was discovered preventing takeoff but the crew chief stated it could be repaired shortly and the flight could proceed.

The day was warm and the airplane was parked in direct sunlight. The pilot paced nervously back and forth, more irritably and more vigorously, as additional small delays occurred. After about an hour and twenty minutes he said he did not feel well enough to make the flight and returned to the ready room. At debrief he looked pale and limp and remarked that he just didn't feel up to completing the mission.

Such symptoms as these are common among individuals experiencing heat illness. They occur regularly among new arrivals in the tropics, and have plagued troop movements into hot climates for centuries. They do not commonly occur in temperate climates except during strenuous physical exercise or labor.

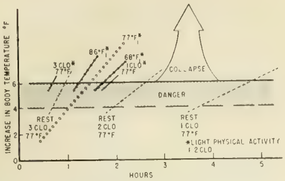
The symptoms of pallor, faintness, and nausea result from circulatory strain due to overheating. When a person becomes sufficiently overheated he will collapse and may die.

Man is a homeothermic animal; one that controls his body temperature automatically. Despite exposure to a wide range of environments, his deep body temperature stays within fairly narrow limits. He does this by sweating to keep cool and shivering to keep warm. A relatively constant temperature is advantageous to the chemical reactions and nervous transmission on which life depends. While this ability to regulate body temperature is necessary for a relatively constant body temperature, it is not always an advantage. It limits man to a temperature environment which will not overtax his regulating capabilities. He can be stressed enough to force body temperature to fatal extremes. Generally, man's mind directs his behavior so that he is provided with artificial means, clothing and shelter, which protect him from environmental extremes. Even the illness experienced under strain, when recognized by the mind as a signal to stop and rest, can be considered as protective in nature.



BODY TEMPERATURE CHANGE
FOR UNVENTILATED PILOT

Conditions of the problem are as follows: The pilot was dressed in an unventilated antiexposure suit and the usual undergarments. He paced the ramp (light muscular activity) waiting for a minor maintenance delay to be corrected. The environmental temperature was 85°F, and part of the time was spent in bright sun which would tend to shift the computed line of heat storage to the left into the shaded area to the left of the curve. When body temperature has increased about 5°F, men are likely to become ill. An increase of 4°F is the maximum that can be tolerated without measurable decreases in performance capabilities.



TOLERANCE LIMITS FOR UNVENTILATED
ANTI-EXPOSURE GARMENTS

The graph shows the computed rates at which the body temperature of a man will increase when wearing an unventilated antiexposure suit. The effects of increased clothing, increased environmental temperature and increased activity are also shown. The upper horizontal line indicates the level of body temperature at which faintness and nausea are likely to occur. The lower horizontal line shows the level below which no serious deterioration occurs.

Man's relationship with his thermal environment is continuously changing. The constancy of his body temperature depends on a more-or-less continuous balance of heat production and heat loss. All living systems produce heat. It is a by-product of the chemical activity which is the basis of life. A resting man produces about 90 kilocalories of heat each hour, enough to melt about two pounds of ice. During any physical activity this heat production increases so that with strenuous exertion a man may produce heat at a rate greater than 1000 kilocalories/hour. Generally this heat is lost in a temperate environment through the evaporation of sweat. If for some reason heat cannot be lost as rapidly as it is produced, the temperature of the body increases. We have learned from experimentation that normally healthy men will experience the symptoms of heat illness when the body temperature has risen about 5 or 6 degrees Fahrenheit. Some increase in body temperature occurs with all strenuous activity. This may increase the efficiency of chemical reactions. Additionally, it increases the rate of heat loss. We also know that in the healthy person symptoms of heat illness do not show until body temperature has risen more than 4°F.

The problem of the pilot in the antiexposure suit was put to the biothermal analog. It can be stated this way: under the following conditions will a man's body temperature increase, and if so at what rate?

- The air temperature is 85°F.
- He is wearing clothing with an insulation value of 2 clo, or about twice that required for comfort in a normal environment.
- His metabolic heat production is that of walking, about 2 times the amount of heat produced when resting.
- Since he is wearing an impermeable antiexposure suit almost none of the sweat he produces will evaporate and so it cannot cool him significantly.

The answer to the problem is shown in Figure 1. According to the analog, the pilot should have reached a critical increase in body temperature in 50 minutes and should have begun to experience symptoms of heat illness at about one hour and 10 minutes. This would have been the case had there been no sun to add heat. Since there was a bright sun, the computed line of temperature change would be shifted to the left and the danger zone entered more quickly.

When the conditions of the incident were checked more precisely it was found that the pilot spent about 45 minutes at temperatures estimated at up to 90°F. Part of the time he was in bright sunlight. An additional 30 minutes elapsed before he returned to the ready room. He refused his replacement aircraft after one hour and 15 minutes of thermal stress. Thus, this unfortunate incident was duplicated by the computer results.

Hypothetical pilots under a variety of temperature stresses, working at various levels of physical activity, and wearing light or heavy clothing, were also handled by the biothermal analog. The composite results are shown in Figure 2. A small amount of study shows that an increase in environmental temperature, physical activity or clothing will decrease the safe exposure time. Sun radiation, although not noted on this figure, will shorten safe exposure time even further.

The problem was well-stated by the flying safety officer, who brought this incident to our attention: "Antiexposure suits and equipment are here to stay and their effectiveness when pressed into the use for which they were designed is immeasurable. We realize that improved designs are on the way, but meanwhile, and that meanwhile gets very long sometimes, this office would like some yardstick . . . of an unventilated survival suit under various degrees of higher ambient temperatures and time."

Based upon the predictions of the computer, and checked from the incident noted, we can answer this query as follows:

Full knowledge of the possible consequences will limit the wear of unventilated antiexposure suits, at ambient temperatures greater than 70°F, to periods not exceeding 30 minutes.

Lt Col Kaufman is assigned to Aerospace Medical Research Laboratories, Aerospace Medical Division, AFSC, Wright-Patterson AFB, Ohio. Doctor Brown is on the staff of the University of Washington, Seattle, Wash. ★

Rex Riley
CROSS COUNTRY NOTES

REX WAS REMINDED recently of a tragedy that occurred last summer when an airman on leave received fatal burns when he squirted starter fluid on an already burning charcoal barbecue fire. There was a flashback, the can ruptured and the airman's clothing was set afire. He died a week later. Others have been luckier—they received only hand and arm burns —if you want to call that lucky. This tragedy occurred as the result of either ignorance or carelessness. If you have read this far, there is no excuse for ignorance. Rex sincerely hopes that good judgment will prevail and that carelessness will not result in a similar fatal accident or serious injury.

THE FAA has a new film that Rex highly recommends for all pilots. It's titled *Wake Turbulence,* is in color and runs 16 minutes. Our FAA reps tell us that the film can be obtained from FAA facilities in your region or from the FAA Film Library, Aeronautical Center, PO Box 25082, Oklahoma City, Okla., 73125. In addition to showing it at flying safety meetings, safety officers might run the film at the next aero club meeting. It will be interesting material for both audiences.

REX DOESN'T KNOW how to take on the subject of gear up landings without parroting the same old clichés, which may or may not do any good. But we had another one the other day, so he feels obligated to tell you what happened and why in hopes that the mere mention will strike a responsive chord in a few heads. After a couple of touch and goes by a student, the IP took over for a full stop landing. On final approach he was explaining to the student how VASI works. Unfortunately he got so engrossed in his instructional responsibilities that he forgot the rollers. Apparently this was another case of altering habit patterns, which is almost always the cause of this type of mishap.

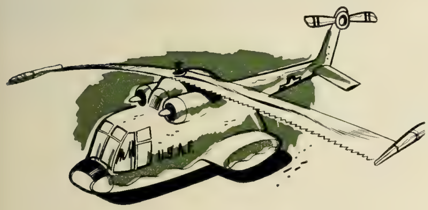
CORRECTION

Reference Page 6, Aerospace Safety, July 1966, Personal Equipment Notes, first paragraph and photos of batteries:

Numbers shown are date of manufacture, not date of expiration. SEG recommends shelf life not exceed two years from date of manufacture.

MOST USAF bases are free of the nemesis of the private airports—power lines just off the end of the runway. But helicopters frequently operate into areas where power lines and other obstacles can catch the unwary. This happened to the pilot of a UH-1F making a landing at a missile launch facility. Prior to landing inside the fenced area of the launch facility, he descended and hovered just outside the fence to take a look at the windsock, which he thought was not rotating properly with the wind. He then landed and later returned to home base where damage to the aircraft was discovered. Although neither pilot felt anything at the time, the damage to the main rotor blade and tail pylon fairing probably occurred during the hover over the windsock. This conclusion was based on the fact that a power line located near the launch facility was severed.

Hazards such as this need to be identified and approaches planned in such a manner to avoid them. Pilots should then fly the approach as planned.



UNDER A PROJECT commissioned by the U.S. Public Health Service, Dr. Donald F. Heulke, an anatomist, and Dr. Paul W. Gikas, a pathologist, both of the University of Michigan, reconstructed each of the 139 fatal accidents that occurred in the Ann Arbor area over a four-year period.

Here's what they found: Forty per cent (71) of the 177 persons who died in the accidents would have lived if they had been wearing a simple lap belt. (Of these, 38 were killed by being thrown from the car; 33 by "secondary collision" with some part of the interior of the car.) Twenty per cent (35) more would have been saved by a shoulder harness and belt. (Of these, 32 were killed in the "secondary collision.") Thirty-seven per cent (66) would have died, regardless of belts, in most cases because the passenger compartment was greatly collapsed.

SOMEBODY SHOULDA BELTED YOU...BOY...!

Dr. Heulke answers with cold statistics the occasional story of someone who survived an accident which would have killed him if he had been belted in: "We have had only one case of a survivor who owes his life to not wearing a seat belt. We have had at least 71 who owe their deaths to not wearing one. Anyone who doesn't wear a seat belt is stupid."

Another statistic speaks eloquently to those who stake their lives on their own skill and caution—their ability to avoid "the other guy." Of 93 victims in multiple-car accidents, 33 (more than a third) perished in the car judged not to be at fault.

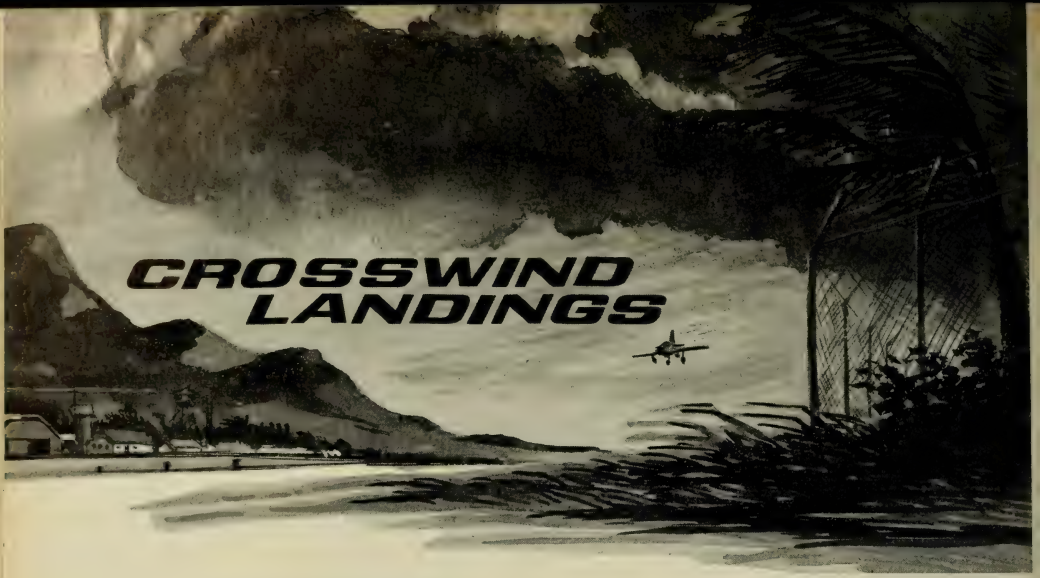
8AF (SAC) Accident Prevention Bulletin

DID YOU HEAR about the pilot who was flying along in his trusty T-Bird when an aileron boost unit suddenly went ape? Seems that when he tried to roll out of a steep left turn the aileron wouldn't neutralize—stayed over to the left. Aileron boost was turned off and on several times but had no effect. The man tried valiantly, with both hands, but he couldn't get the wings back to level. However, he did get control, although with a 45-degree bank.

The back seat occupant of this bird was a non-rated airman whose aid was immediately enlisted. The pilot gave him some fast flight instruction and got him on the stick—literally. Between the two of them they managed to level the wings. After checking flight characteristics, the pilot decided he could land. A straight-in approach was initiated with the airman holding right aileron with both hands. This enabled the pilot to free one hand to handle the throttle. After the successful landing, the pilot said he could not have landed without the airman's help.

Apparently this aileron boost malfunction was caused by contamination of the hydraulic filter element. The element was bulged, which indicated internal or back pressure. When the boost unit was connected to the hydraulic test stand, pressure set at 1000 psi and the return line partially closed, the condition encountered in flight occurred. However, no hydraulic contamination could be found by visual inspection. The reservoir filter and a hydraulic fluid sample were removed to be analyzed for contamination. ★

CROSSWIND LANDINGS



An Italian pilot demonstrating an aircraft at last year's Paris Air Show was called the world's best by some of the other participating fighter pilots. During his demonstration, he flew an inverted traffic pattern and rolled upright on final for his landing. Because of traffic, the tower had him take it around; he made a closed pattern into the wind. Unfortunately the crosswind was acting upon the aircraft throughout the closed pattern and the base to final turn was really tight. Too tight, because the aircraft snapped, crashed, and the world's best was killed by a sneaky crosswind. If it happened to "the best," it could also happen to any other pilot.

Maj James L. Foster
4510 Combat Crew Training Wing (TAC)
Luke AFB, Arizona

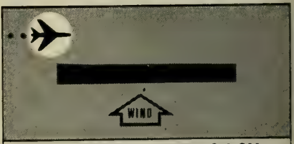
Unlike many other facets that make up the business of flying, crosswind landings always rank high in gaining the attention and respect of the pilot. Or, shall we say, "Let's hope they do!"

Generally speaking, a pilot learns early in his career that crosswind landings not only cause the inherent problem of lateral displacement during the landing operation, but also those problems related to such factors as the physical limitations of the particular aircraft, and the landing conditions.

This discussion is limited to crosswind landings from the standpoint of how they affect our flying at Luke in both the F-100 and F-104 aircraft. These basic procedures will apply to all other bases, but there are usually certain environmental factors common to each base that will also have their effect.

First of all, always be prepared to cope with a crosswind landing. It is not unusual to depart Luke under mild wind conditions only to return for landing an hour or so later with a brisk crosswind present. This is true for many Air Force bases.

If you know prior to flight that you'll be landing in a crosswind, review the procedures in your preflight briefing. This brings up a point directed primarily at IPs. When you check the forecast weather prior to briefing, consider the forecast surface wind conditions. Remember, also, that crosswinds present special problems involving formation flights. Some of these will be discussed in this presentation. Let's look at all phases of the landing pattern.



THE INITIAL APPROACH

If a crosswind exists, be aware of it no later than the initial approach. This is where you must plan your pattern and be prepared to make necessary adjustments. Therefore, know the direction of the crosswind, its velocity, and its resultant effective component.

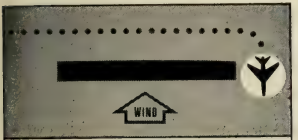
Our conscientious senior controllers are aware when a crosswind is likely to cause problems in the pattern. They are careful to emphasize this to flights on initial, so pay attention, because the rest is up to you.

The crosswind direction on the surface will usually be present at traffic pattern altitude and at a slightly greater velocity. Knowing this in advance will permit you to make necessary adjustments on initial, during your break, and especially during downwind positioning.

As you come down initial, determine then and there if the crosswind is a potential "widow maker." By this we mean, "Will it force you into a tight base-to-final turn unless you make necessary pattern adjustments?" A good rule of thumb to use in making this determination is this: If the direction of traffic and direction of crosswind are the same, use caution. For example: Left—left. A left-hand pattern-left crosswind will cause a tight base to final turn unless you make corrections.

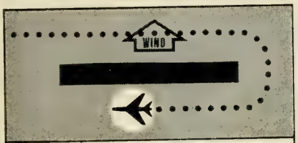
As far as flying the initial approach, crab sufficiently to avoid being forced inside or outside of your normal breaking point. This is particularly important if you are breaking into the crosswind. If you are forced outside or to the right of your breaking point while on initial, you will end up with a close-in downwind which will compound your problem when turning base to final.

If the crosswind is opposite the direction of traffic, i.e., left traffic, right crosswind, the potentially dangerous aspects of the pattern are reduced, *but*, unless necessary adjustments are made, it can cause some unnecessarily sloppy patterns, such as an extremely wide downwind and angling base to final turns.



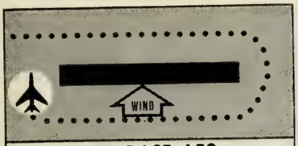
THE BREAK

When breaking *into* the crosswind, loosen up your break. A normal or tight break will result in a close-in downwind. When breaking *with* a crosswind, a slightly tightened break will help keep your downwind in. The break is where the flight leader of a formation flight is really carrying the load. He must set the pattern up so the wingmen can follow suit. If the leader breaks shallow, each subsequent member should do the same by matching the bank angle of the aircraft ahead of him. This will result in a uniform downwind.



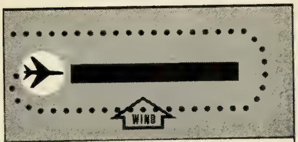
THE DOWNWIND

Crab into the crosswind while on downwind. A brisk crosswind of 15, 20, or 25 knots will take a sizable correction. While on downwind, it is better to use too much than too little since you can make up for it during your base to final turn. One degree of correction for each knot of effective crosswind is a good rule of thumb. Cross-check your position with the runway and if time permits, make necessary corrections.



THE BASE LEG

This is the part of the pattern that demands the most attention, especially with a crosswind from the pattern side. We'll approach it from that standpoint. If the corrections discussed previously were applied, your problems at this point in the pattern will be minimized. As you start your base leg turn, frequently crosscheck your position with respect to the runway centerline to avoid overshooting. Remember—the crosswind is tending to push you at a faster than normal rate toward centerline, so speed up your crosscheck. Keep your initial bank in until you're sure you are not overshooting. It is much easier and safer to shallow out your bank as you progress around the turn than to steepen up your turn at the last instant to avoid overshooting. In fact, it is this lesson that has proven so costly in pilots' lives and aircraft. Therefore, if you fail to detect the overshoot and suddenly find yourself steepening your bank and applying excessive back pressure, roll wings level, while adding power, and take it around from there. While flying base leg, be power and airspeed conscious—this will help you keep out of trouble.



THE FINAL

Up to this point in the discussion, the techniques apply to both the F-100 and F-104 aircraft. However, from this point on, the techniques vary slightly between aircraft (see the Dash One for your model).

As you roll out on final, correct into the crosswind and line up with the runway.

F-100s may use the crab or wing down technique.

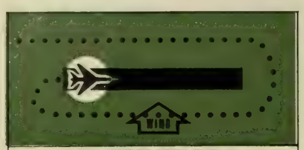
F-104s may use the crab or wing down method or a combination of both.

F-100—If the effective crosswind is 25 knots or greater, make a "no flap" approach and landing.

This is the point in the approach where you will find that it doesn't pay to fly tight patterns. The patterns as described for *both* aircraft require a one-mile final. This final, especially in a crosswind, allows you sufficient time to kill your drift and stabilize your approach. Slow your aircraft to proper final approach speed, plus your crosswind factor. F-100s use one-half the velocity of the direct crosswind component. F-104s add five knots for every 10 knots of effective crosswind. It's really the same but stated in a different manner. This correction is also applied to the touchdown speed.

CROSSWIND LANDINGS

CONTINUED



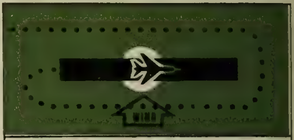
THE TOUCHDOWN

F-100s—If using the crabbing method down final, take out the crab and align the aircraft with the runway just prior to touchdown. If you find yourself taking the crab out too early and the aircraft begins to drift toward the side of the runway, apply rudder correction and lower your wing into the wind to check the drift.

F-104s—Maintain your crab or wing low approach during flare and touchdown. Be prepared to increase the crosswind correction as your airspeed is reduced for touchdown.

The most important point, which applies to both aircraft, is to lower the nose and engage nose wheel steering immediately after touchdown. Above all else, do *not* deploy the drag chute until you are sure nose wheel steering is engaged. F-100s: Occasionally some difficulty is encountered aligning the rudder pedals to pick up nose wheel steering. Be aware that this can occur and be prepared to align the rudder pedals with the nose wheel to pick up steering. Be prepared to use brakes for directional control and hold the nose wheel steering button depressed until steering is engaged. For this reason, the drag chute must not be deployed until positive nose wheel steering is attained. Premature deployment of the drag chute without positive steering can aggravate the situation beyond control.

F-104s have virtually the same problem except that the nose wheel steering button should not be activated until the nose wheel and rudder pedals are aligned. Again, do not deploy the chute until you are sure you have nose wheel steering.



THE LANDING ROLL

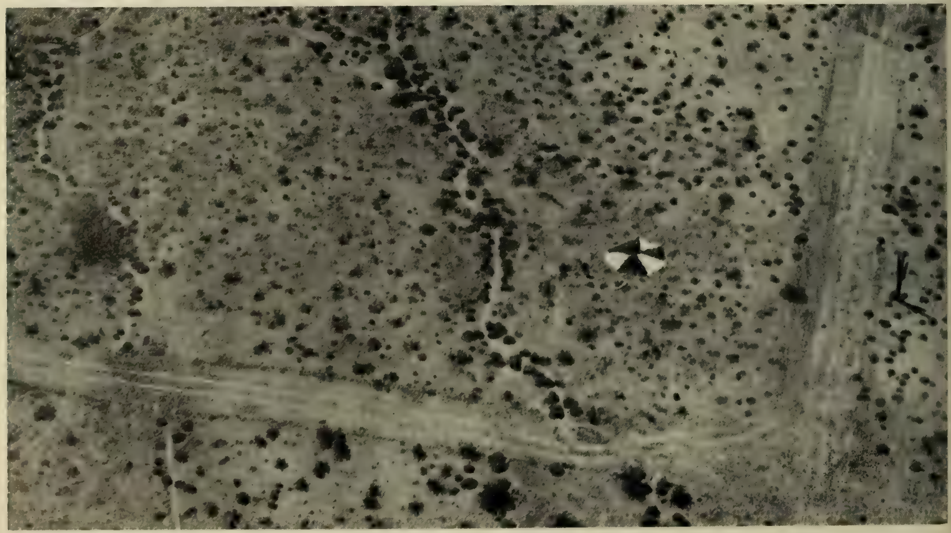
Maintain directional control with nose wheel steering and, if necessary, differential braking. If the crosswind is causing severe weathervaning with the drag chute deployed, to the extent that directional control cannot be maintained, jettison the drag chute.

A good follow-through technique during the landing roll to insure positive nose wheel steering is to hold forward stick pressure and trim nose down.

(This article was adapted from material presented by Major Foster during a flying safety meeting at Luke AFB. We are indebted to Major Bruce D. Jones, Chief of Safety, 4510 Combat Crew Training Wing, for his assistance in obtaining the material. Ed.) ★

DOWNED PILOT:

Spread canopy makes pilot easier to spot. Even better would be a move to the road where contrast would be greater and shadows would not be so confusing.



Missilanea

FALCONS DAMAGED during transportation, loading and unloading usually bring to mind the picture of a bird ruffled during loading on an alert aircraft, or during ground handling and movement from on-base storage to the alert aircraft loading area. The Falcon mishaps that have cost us the most, however, did not occur in this area of missile handling.

Mishaps that have been reported as occurring during interceptor aircraft loading/downloading have usually involved single missiles with minor damage. Procedures are well established with specialized equipment (trailers, tow vehicles, handling frames) to perform these functions. Crews are specifically trained for, and supervised in, the performance of these duties.

Falcons handled as cargo in the receiving and shipping area fail to receive the same quality of specialized handling they received in the alert area. Procedures frequently vary between bases. General purpose type vehicles (trailers and trucks) are often used for transportation between the receiving point and missile storage area. Motor pool and air freight personnel normally perform the loading and transportation. When mishaps occur they involve not one, but several missiles. Falcons dropped (spilled) from fork lifts, trailers, or other general-purpose handling equipment usually result in rocket motors being rejected for further use, guidance unit replacement, or return of the complete missile to the depot for major repair.

Let's look at just a few of the most recent mishaps of this nature:

- Incoming shipment of missiles was being unloaded from a flat-bed semi-trailer to a fork lift when two $11,686 Falcons in shipping containers slid from the fork lift and dropped approximately 10 feet to the ground . . .

- Twenty-six Falcons were offloaded onto a flatbed trailer for transportation to the storage area. A motor pool driver was dispatched to exchange tractors prior to making a trip to the storage area. Before disengaging the tractor from the trailer, the driver cranked down the jack-pad on the right side but neglected to crank down the left jack-pad. When he drove the tractor from under the flat-bed trailer, the trailer tipped, allowing three $12,038 Falcons, and two $11,687 Falcons to slide to the ground. (Slide? They *crashed* to the ground!) . . .

- Forty-eight Falcon missiles were loaded on four pallets (12 per pallet) on a 40-foot trailer for transportation. En route with the load, the driver made a right turn onto an unpaved smooth dirt road. The load shifted, breaking the single tiedown strap on the third pallet. Nine of the twelve Falcons fell to the ground.

Corrective action was indicated with each report. All were caused by supervisory error and/or personnel error. These three mishaps within a six-months period seriously damaged 14 Falcons. More Falcons were damaged during these three mishaps than during all the hundreds of alert, training and mass loadings and related transportation for an entire year.

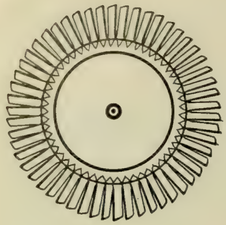
Air Freight and Motor Pool procedures, personnel qualifications, and supervision of missile and munitions handling need the special attention of the unit commander and his safety officer. Local procedures and practices should be evaluated and revised where necessary.

Lt Col Loren S. Tyler
Directorate of Aerospace Safety

HOUND DOG PUNCH. Approximately 30 minutes after AGM-28 power was applied, the Nr 1 warning light on the Navigator's Armament panel and the warhead light on the Navigator's launch panel illuminated. All power was immediately removed from the missile. After the aircraft landed, the Hound Dog was downloaded. All critical aircraft circuits were checked and no malfunctions detected. During checkout of the missile autonavigator compartment, four wires were discovered cut on the dummy warhead cable. Investigation revealed that, as the dummy warhead was being raised into the AGM-28, a sudden gust of wind raised the left aircraft wing and missile. As the missile lowered, it struck the dummy warhead. A visual inspection at the time revealed no damage to the missile or warhead. It is suspected that the cable was damaged when the missile lowered into the dummy warhead. This was not detected during the upload since the cut on the cable was under the clamp which holds the cable to the side of the warhead adapter.

TO 21M-AGM-28A-2-2 states that during AGM-28A/B loading and unloading operations in variable wind conditions, caution should be exercised to insure the aircraft remains stable. Stabilization may be accomplished by fueling or using tip protection gear support, tip protection gear jacks, or hangar runup ramps. When wind velocity is above 30 knots, load or unload only in case of emergency. ★

Maj E. D. Jenkins
Directorate of Aerospace Safety



WHY ENGINE STALLS?

E. L. Venturini, Manager

Technical Investigations Service Engineering, FPD, Cincinnati, Ohio

"I think the engine stalled . . . Would you check it over and, oh, yeah . . . let me know whatcha find?"

That's what Major Staller said to his crew chief after yesterday's hop. That was the same bird in which I had experienced a boomer no more than two days ago. I didn't write it up because I thought I'd goofed in my pull-up in a gunnery pass. But then my curiosity got to me so I called up an old friend, A. Grate D'Zeiner for some facts.

"Vell, da perfect comprezzor vould operate on an izentropic proceez. Now, an izentropic proceez resultz in a minimoom temperature ratio acrozz da comprezzor for a geeven prezzure ratio. Derfore da efficiency. . . ."

"Hold on," I interrupted. "In plain language, why does an engine stall?" Well, I still didn't get very far but I remembered some articles I'd seen in the briefing room.

First, let's clear up one point! All explosive sounds, whines and growls or similar sensations you might experience, are not engine stalls. But before we get into the recognition of an engine stall, it would help to know what happens and why.

We're all familiar with the way an aircraft wing stalls. When the angle of attack is increased beyond that required for flight, the drag increases causing turbulence in the airflow over the wings. Turbulence reduces the lift created by smooth flowing high velocity air. If the turbulence from a high angle of attack is great enough, the lift produced is no longer sufficient to support flight. Figure 1 shows a simplified airfoil and this effect. Since the axial flow compressor is made up of a series of specially shaped airfoils, the application of this principle applies as well to the axial flow compressor of a jet engine. I mention axial flow because most of our equipment these days is this type.

The compressor rotor has hundreds of fixed airfoils rotating like a propellor blade, each one creat-

Distortion of pressure profile at engine inlet from FOD, extreme maneuvers may cause engine to stall.

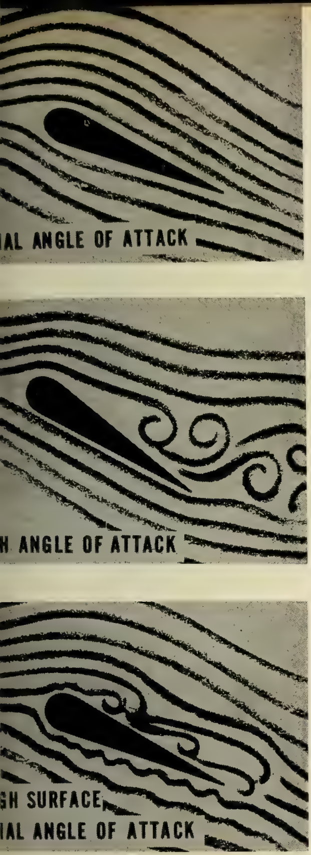


Figure 1

Figure 2

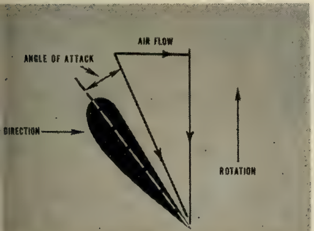
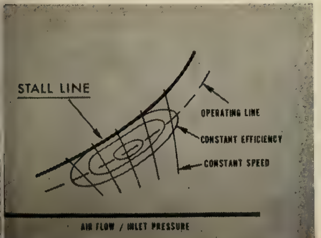


Figure 3



ing a pressure rise in the air being supplied to the combustion section. The compressor stator which is also comprised of hundreds of fixed airfoils directs the air during the compression cycles. In the process, either rotor or stator blades have the capability of stalling much the same way as the airplane wing. If you isolate one blade in the compressor rotor for a closer look, Figure 2, you see a cross section of a blade airfoil, its rotational speed vector, the air direction with its velocity vector, and resultant air vector relative to the blade.

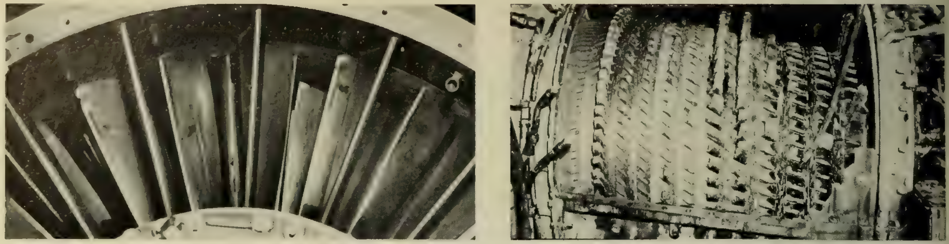
As in the case of an aircraft wing, if the angle of attack is too great, the airfoil will stall. It is not necessary that the entire airfoil be involved. A stall can initiate in the tip or hub area, persist in a localized manner or progress into a full fledged stall where the compressor ceases to function. Since the blade is fixed, what changes the angle of attack? There are four factors that influence this: (1) the air velocity, (2) the blade or engine speed, (3) the stator vane position and (4) the desired pressure rise.

The diagram in Figure 2 depicts one given condition, and a similar diagram can be shown for a stator blade. The compressor must be designed to function efficiently at an infinite number of conditions as set forth by aircraft speed and altitude and all kinds of weather. That is, inlet air temperature, pressure and humidity, as well as engine RPM and its condition.

As an example, let's consider a case where the engine is running at a stabilized speed. Air enters the compressor flowing axially; however, to the rotating blade it appears to be flowing in the direction of the resultant as shown in Figure 2. The air is compressed and in the process, exits each stage with a velocity somewhat in the direction of rotation. Stator vanes then turn the air to the proper direction or angle of attack for the next compression cycle, etc., through the entire compressor. Now that's for only one condition. As mentioned, in the design of a compressor many variables must be considered. The engine speed may vary from zero to several thousand RPM, engine inlet temperature from well below freezing to above boiling and operation at a wide range of altitudes. The compressor, irrespective of conditions, must produce and yet not stall.

How's this done? For every compressor design, a dimensionless plot or map can be made of compression ratio versus air flow. A typical compressor map is shown in Figure 3. The diagram also defines the constant speed and efficiency lines. Air flow increases with speed to get thrust. To gain efficiency and better performance, a greater pressure ratio must also be realized. The higher the pressure ratio, the higher the angle of attack and operation closer to the stall line. However, operation here is critical, and stepping over the line will lead to a stall. So what happens? . . . you devise an operating line which skirts the stall line with some degree of margin.

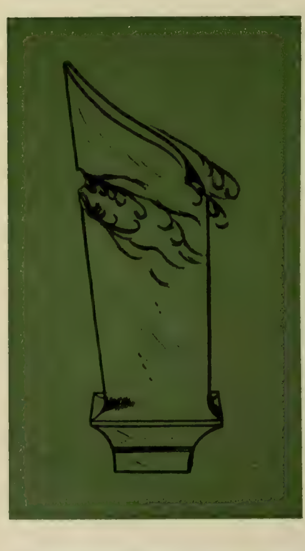
The operating line is the product of much development testing and engineering judgment. Operation of the engine along this path is accomplished in many different ways. In the variable compressor stator system, the early stage vanes are positioned as a function of inlet temperature and engine speed to maintain the proper control of the airflow. The pressure ratio is controlled by many parameters, yet fixed by the geometry of the basic engine. Dual spooled compressors accomplish much the same end by providing an RPM match between forward and aft states at all speeds points (higher speed ratio in aft stages during acceleration). A compressor bleed air system regulates the pressure rise in the transient speed range. The fuel scheduled for combustion during acceleration and the corre-



FOD is often the villain causing engine to stall.

sponding exhaust nozzle area, if variable, will affect the pressure level in the engine system. These schedules must be compatible. For example, if too high a rate of fuel is being burned, or for some reason the exhaust nozzle is closed, a high pressure will exist in the combustion section. This will raise the pressure ratio in the compressor and could cause a stall. Once a suitable operating line is established, intentional stall tests are conducted to evaluate the final product. Now that's how it works, but why doesn't it always? I'm glad you asked! The conditions we've discussed were ideal with only some degree of provisions for changes in stall margin which may come about in the course of field operation. The compressor air flow characteristics will change as a result of airfoil corrosion, dirt and even foreign object damage. Control schedules or regulating valve operation can change with time.

Figure 4



When the airfoil surfaces of the compressor become rough from corrosion or dirt deposits, the airfoil becomes prone to flow separation, turbulence and eventually stall. See Figure 1C. Obviously the answer to this problem is corrosive resistant materials or protective coatings. Both approaches have shown significant improvements in the past few years and are being incorporated in the engine designs. Wash-oil and walnut shelling techniques have been developed to clean up the old designs and keep them going between overhauls.

Foreign Object Damage to compressors has taken its toll in causing stalls. It's not hard to understand why the disturbance generated, would cause a stall. See Figure 4. The turbulence created would be comparable to that of an iced wing or as in a high angle of attack.

Nothing's been mentioned about aircraft/pilot induced stalls. These occur from the ingestion of hot gases from rockets or guns, inlet ramp schedule failures, spins and other exotic maneuvers—all produce a distorted pressure profile at the engine inlet. The cases cited here have caused engines to stall which had adequate stall margin.

The symptoms of an engine stall may vary among the different aircraft; however, most common displays are a sudden increase in exhaust temperature, some RPM loss or hang-up, a thrust decrease and frequently an audible report. Compressor stalls are generally cleared by reducing power; however, one should refer to the appropriate manuals for the recommended procedures.

Now let's review. . . . Oh, there's the crew chief Sgt. Ringitout, on that bird Major Staller brought back.

"Hey, Sarge, whadya find?"

"Afraid it's FOD, sir!"

FOD huh. . . . Wonder what they call FOD in foreign countries? Whatever it's called it's costly, and won't Staller be happy to hear the news, being the maintenance officer? What about maintenance? Can't we reduce the stall incidents with improved maintenance? No question about it. You recall the cause factors: Compressor corrosion, FOD, exhaust nozzle malfunction, fuel control schedule, inlet ramp failure. Many can't be foreseen it's true, but still a good percentage are not recognized during maintenance.

In summary, the best pilots are familiar with the recognition and proper corrective measures in abnormal or emergency conditions . . . keep ahead or at least current on engine stalls. And mechanics, your work should never stop in preventing stalls through good maintenance practices.

Don't forget, if you guess, you might be wrong and if you think you guessed right, you only thought you knew. ★

10 Years Without An Accident

Ten years is 120 months or 3650 days; and it can be measured in any other unit one desires. The 932d Troop Carrier Group measures this period of time by the number of accidents the group experienced from August 1955 to August 1965. The answer comes out ZERO. This is considered an outstanding accomplishment for any Air Force unit, however, the 932d is a Reserve organization comprised of citizen-airmen who perform their flying duties in addition to pursuing professional careers outside the Air Force.

"Safety First" has always been the motto of the unit at Scott AFB; however, the decade did not pass without its moments where quick and professional decisions were required to maintain the flawless record.

Binding elevator controls and a jammed gear threatened a crash landing on the night of 19 May 1958. While the C-119 circled over Scott Air Force Base, the crew sought to locate the trouble. Failure of the nose gear strut pin had caused the nose gear to become jammed in the wheel well. The condition prevented full retraction of the gear, caused the elevator controls to bind and prevented the gear from extending. After four hours of futile efforts to lower the gear, the flight engineer removed his parachute and as a safety measure, a strap was tied around his waist and secured to the aircraft. He then entered the nose wheel section, chained the gear in the up position with cargo chains to prevent its inadvertently extending, and the wheel well door rod was removed, letting the door free fall to the open position. This provided sufficient room, the chain was removed and the gear was then lowered and locked into position. A safety pin was installed but the problem was not entirely solved. The nose gear remained eight degrees out of line, raising the fear that it might collapse upon landing. At the request of the aircraft commander, ground personnel sprayed foam on the runway. The pilot's smooth landing brought a successful end to the hectic flight.

After the aircraft stopped its landing roll, gear pins were inserted and the aircraft was towed to the Reserve Area. The crew's efforts averted a major accident, possibly saving the lives of the seven men on board and the loss of an aircraft. The flight engineer received a Distinguished Flying Cross for "heroism and extraordinary achievement" which was believed to be the first instance where an Air Force Reservist, not on extended active duty, received the award; and the entire crew received a "Well Done" in Flying Safety magazine.

In another incident, during a massive exercise conducted by the Air Force and Army in North Carolina in 1960, quick-thinking by one of the pilots averted a possible accident. His C-119 from Scott AFB was preparing to drop an Army truck when a series of mishaps occurred. First, a small pilot chute malfunctioned and the two big chutes attached to the truck and platform did not leave the aircraft. The pilot ordered that the truck and its platform, weighing a total of 7000 pounds, be secured with chains. A few moments later, one of the big chutes popped out of the Flying Boxcar and opened, working like a brake to slow down the aircraft. Already slowed to 130 knots for the paradrop, the plane rapidly lost airspeed with the additional drag. The pilot ordered the crew to cut the big chute loose and the aircraft was landed safely at a nearby base.

Both emergencies were handled professionally by the aircrews. Other incidents which required immediate inflight decisions and sometimes unscheduled single engine landings, while not as dramatic, threatened to mar the record.

During the 10-year period, 932d crews logged 43,323 hours flying missions over routes nearly circling the globe, over all types of terrain and in a wide range of adverse weather conditions. For the first 20 months of the decade, the organization was a bombardment wing and most flights were in B-26s. In 1957 the C-119s arrived and brought with them many problems.

Only three pilots in the organization had previous time in the Boxcars and this was a scant number. Instructor pilots came to Scott from other organizations to conduct transition training. Maintenance of the troop carrier aircraft also caused a few headaches at the start. The Reserve organization was a Pilot Training Wing with T-28s and T-33s (the latter assigned for a very short period) prior to the transfer to Scott of the Bombardment Wing with B-26s. Therefore, the hangar did not accommodate the '119s and alterations were made to permit entrance of the larger aircraft. There was a shortage of maintenance platforms and special tools peculiar to the C-119 such as propeller and engine tools. Until proper tools were received, maintenance men employed ingenuity and skillfully used make-shift tools to accomplish certain jobs.

Flights by Reservists in the C-119s have been of a wider variety than was possible in their previous aircraft. They included overwater navigation missions to Panama, Puerto Rico and Bermuda; ferrying missions from Hawaii and France to Scott, and from Scott to India; airborne troop exercises in Alaska, the West Coast and southeast United States; paradrop missions over drop zones throughout the country; airlift missions to provide vitally needed supplies to the Dominican Republic and to flood-stricken areas in the Midwest.

A secondary mission was assigned to the Wing in early 1961, when it became the first reserve organization to augment the Air Force space capsule recovery operations. One crew from the 932d was trained by the AF Recovery Unit in Hawaii; this crew then trained an additional three crews for a total of four crews of "aerial outfielders."

The "Ready Now" concept under which the Air Force Reserve operates was tested by recall of the unit to active duty during the crisis in Cuba in October 1962. Designated the 73d Troop Carrier Squadron, the unit was one of 24 squadrons summoned in the no-notice recall. During a training assembly on 28 October 1962, the Reservists received word that they were on active duty as of that time for a period of 12 months unless sooner relieved. They immediately became part of the Tactical Air Command forces, poised for action over Cuba if the "hot line" call should so order. Due to its high state of readiness, the Scott unit smoothly and quickly became a part of the Nation's front-line defenses. The crisis subsided and the unit was released from active duty on 28 November 1962.

The 932d has provided direct support of the active duty forces on numerous occasions in the decade. These missions included Swiftlife and CON TAC, providing airlift augmentation to TAC through the execution of specific cargo and personnel missions; Ready Swap, providing airlift support for Air Force Logistics Command by transferring weapon systems material between AFLC depots; Swordfish, providing support to the Air Defense Engineering Services Systems test organization; and MAC Support, providing airlift on Atlantic and Caribbean routes in support of the Military Airlift Command. Most of these missions were accomplished by Reserve crews on short tours of active duty.

Flying Safety has been given a position of paramount importance in all missions during the 10-year period. In September 1955, the unit began a flying safety program involving weekly meetings of aircrew members. It stressed that flying safety could not be compromised in any peacetime mission. The program insured that proper actions were taken prior to each flight, that crews received proper rest, and that authorized procedures were followed. Commanders and Flying Safety Officers have continued to stress this at every flying period. Each member of the unit maintains a "flying safety attitude" by his conscientious efforts to keep current on Air Force directives, flying safety bulletins, aircraft procedures and flying techniques. Each man attends monthly flying safety meetings, alerts the unit to any hazardous incidents or tendencies he has observed, and maintains standardization in all flying and ground activities.

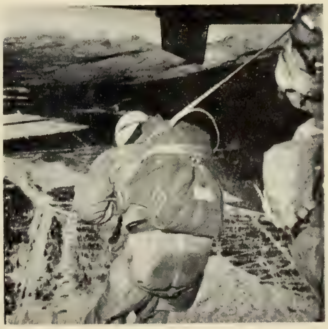
Colonel Allen A. Beaumont, 932d Commander, is quick to point out that the aircrews alone did not achieve the 10 year flying safety record. Excellent aircraft maintenance played an important part.

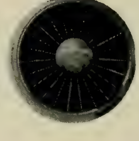
On-the-job training in the 932d was given credit for developing the skills of many airmen who helped produce the safety record. A large percentage of enlisted men had no prior service in the military. Most of the pilots, navigators and flight engineers had little or no experience in troop carrier operations when the unit converted to the C-119s or when they joined the unit. The work of instructors has brought these men to a high state of combat readiness.

One pilot, assigned in April 1962, had not flown since June 1949 and had only 120 hours of flying time in two-engine aircraft. In three years, he logged 1502 hours in the Scott C-119s and became an aircraft commander. The SEF Commander who entered the unit in 1956 with 1004 hours flying time, has now logged over 4200 hours. Another pilot came into the unit in 1960 with only 299 hours total time, including 261 hours as a student pilot. His progress in flying the '119s has been steady and he now has over 1600 flying hours and is checked out as an aircraft commander. Other pilots who are now in command of important airlift missions had a wide variety of AF backgrounds — in helicopters, jet fighters and jet bombers.

With 10 years of accident-free flying behind them, the men of the 932d realize that every flight presents a new challenge. They are not looking back to past laurels, but ahead to new threats. They pursue a continuing program of safe flying—in the cockpit, in meetings and briefings, atop maintenance platforms and in their homes. For these men, safety and mission accomplishment go hand-in-hand. ★

(The 932d's long accident-free record ended on 17 April 1966. During an emergency single engine go-around, failure of the remaining generator voltage regulator resulted in a major accident. Ed.)



AER  BITS

REEL NEWS – The following color films are available to your local film library or film servicing activity. Bases without such service may order from the address shown below, an Aerospace Audio-Visual Service (MAC).

TF 5614 FOREIGN OBJECT DAMAGE, 16 min. Describes USAF's program to reduce costly jet engine damage caused by ingestion of foreign objects. Shows runway testing techniques which include debris patterns, vortex formations and tail blast effects.

TF 5597 HAZARDS OF WEAPONS DELIVERY–Tactical Fighter Aircraft, 20 min. Reviews flight safety rules; points out critical dangers in exceeding safety margins; discusses dive angles, roll-ins, roll-outs, recovery time, etc.

TF 5656 EVACUATION PROCEDURES–C-141, 13 min. Outlines duties and responsibilities of crewmembers preparatory to ditching, bailout or wheels-up landing.

TF 5638 PETROLEUM TANK CLEANING SUPERVISOR, 34 min. Outlines principles and dangers of petroleum storage tank cleaning operations, tank preparation and safety rules.

AF Film Library Center
8900 So. Broadway
St. Louis, Mo. 63125

WHODUNIT – "Hello, Chief, . . . I have the whole story . . . saw the whole thing from my hideout in the F-4C wheel well. This mechanic started out okay; I think he was trying to do a good job but got just a little bit careless. First, he took everything out of his pockets and put it on the maintenance stand. Then he inspected the Nr 2 engine intake. After that he moved the stand to the Nr 1 engine, but in the process the engine book fell off the stand onto the ground. He picked it up and put it in his pocket, then, somehow, the book got into the Nr 1 engine during the pre-run inspection.

"Well, you know what happened. During the run, the book and its metal rings got chewed up by the engine – it was horrible, Chief. Fifty per cent of the compressor rotors were damaged, and 99 stators will have to be replaced.

"Chief, would you belive that it will cost almost $20,000, plus labor? Well, you'd better believe it. What's that? Sure I got a recommendation. Let's cut the pockets off the coveralls."

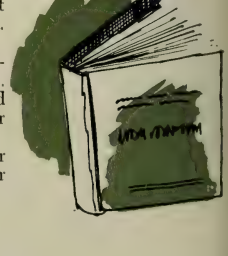
A NUCLEAR SAFETY correspondence course is now available through the Air University Extension Course Institute. This training course – Nr 01955, in three volumes – is designed for people who have direct or indirect responsibility or interest in nuclear safety. Those desiring to study this important subject should consult Part IX, page 9-ECI-3, AFM-50-5 USAF Formal Schools Catalogue, for course description, and Part I, pages 1-28, of the same manual for enrollment procedures and other helpful information.

Volume titles are:

Volume I: Organization and Management, valued at 12 hours or four points.

Volume II: Human Reliability and Safety Procedures, valued at 24 hours or eight points.

Volume III: Before, During and After Accidents, valued at 12 hours or four points.



BLOWN CANOPY — During shutdown of a T-33 at night, the canopy was jettisoned when the pilot's unzipped lower right pocket engaged the canopy alternate jettison handle. Although the primary cause of the minor accident was incomplete compliance with the T.O., which placed a guard around the handle, the quite experienced pilot had some cogent comments which apply to almost all cockpit situations. Among them are:

- Wear proper size flying suit and keep zippers closed.
- Use flashlight instead of contortions to make visual check of switches on night start-up and shutdown.
- When clothing or equipment gets hung up in the cockpit, check the trouble before pulling free.

Maj Guy J. Sherrill
Directorate of Aerospace Safety

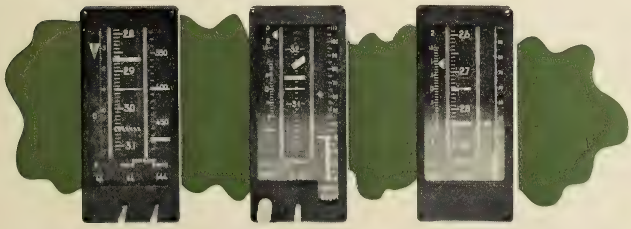
CLOTHING AGAIN—Major Sherrill's item above brings to mind another recent occurrence. During air refueling of a B-52, the copilot got an inadvertent disconnect. The pilot reached over to make sure the throttles were retarded to idle and in the process caught the sleeve tightening tab of his flying suit on the airbrake lever. The extended airbrakes caused the aircraft to fly up into the tanker's jet wash, which caused plenty of control problems until the brakes were retracted and the aircraft descended below the wash.

There must be some way of designing flying clothing so that loops and straps and the trouble they frequently cause can be eliminated.

LIGHT REFLECTING off instrument windows has long been a nuisance to pilots and, on occasion, hazardous. Now something is being done about it on our newest aircraft, the F-111, C-141 and the forthcoming C-5.

The stuff that does the job is a multilayered, dielectric, antireflection coating called HEA. It was designed for use on aircraft instrument windows but is also seeing service on some spacecraft windows. It reduces glare by a factor of 10, and increases the light transmission property of glass so that when one looks directly into an instrument face there appears to be no glass there at all.

Probably your question now is, "If this is so good, when will I get it in the aircraft I fly?" Soon, we hope, but don't hold your breath. The coated glass is not a requirement at present for old instruments and we can't say if it ever will be — cost appears to be the problem. But there is a requirement for HEA on some of the new instruments, e.g., the new ADI and HSI being retrofitted into the B-52, the counterdrum-pointer altimeter that should soon appear in the F-111 and C-141 and is scheduled to be incorporated in the T-38 later this year.



HIGH EFFICIENCY

MAGNESIUM FLUORIDE

NO COATING

AERO BITS

DURING FLIGHT the crew of a T-37 smelled a pungent odor in the cockpit and decided to land. Maintenance, in going over the bird, discovered a three-inch metal clip — the kind used to hold checklists — in contact with the starter relay and the metal bulkhead back of the left seat. The clip caused a short during ground start. Heat generated burned a hole three inches long and ⅛ in. wide in the bulkhead and baked a portion of the fuel cell behind the burned area. Repair cost 50 manhours.

ATTENTION, AERO CLUBS — As of April, according to the FAA, the name of Periodic Inspection was changed to Annual Inspection. All entries in log books or aircraft records will be made using the word "annual" instead of the word "periodic." There will be no change in the scope of the inspection or by whom it is to be performed. The change is in name only. FAA forms such as the 2350, Aircraft Use and Inspection Report, and 2912, Inspection Reminder, can be used without changing the word "periodic" on the form. However, all log book entries or correspondence will refer only to annual inspection.

AT 1130 a pilot was assigned an F-102 for a 1330 scheduled takeoff. He was told to preflight and set up the aircraft and standby in the cockpit as a spare in case an aircraft on the 1200 mission should abort. This is a normal procedure during refueling training in order to obtain maximum training on each tanker mission. A thorough preflight was completed. When the aircraft was not needed to fill in on the 1200 mission, the pilot returned to Operations, leaving the aircraft set up. The crew chief went to eat lunch.

At 1230 the nitrogen system was serviced as directed by Maintenance Control, and the access door was closed but not secured.

At 1300 the pilot and crew chief returned to the aircraft for the 1330 mission. Assuming that it was still completely set up, they did not accomplish a walk-around inspection. Start and taxi were normal and a wing takeoff was made. Just after leaving the ground, the pilot saw the right forward (nitrogen filler) access door come open. He retracted the gear and climbed to a safe ejection altitude. At about 210 KIAS the door separated from the aircraft and the pilot heard two loud bangs similar to a compressor stall. He checked the engine instruments and all appeared normal, so he assumed the noise was the door hitting the aircraft fuselage. He came out of afterburner, climbed to 3000 feet and held the airspeed at 220 KIAS. Since he had never made a heavy weight landing in the F-102 and the engine appeared to be running normally, he elected to burn down some fuel prior to landing. No further problems were encountered, and an uneventful landing was made 20 minutes later.

This was a costly oversight; the left intake duct lip and boundary layer duct were dented and gouged. The engine swallowed at least part of the access door, necessitating an engine change.

Maintenance supervision was judged the primary cause because there was no procedure to insure access doors being properly secured after servicing. Contributors were maintenance personnel who failed to secure the door, and the crew chief and pilot for not making a walk-around inspection after leaving the aircraft for an extended period.

Needless to say, this unit began writing an OI designed to prevent this sort of thing. ★

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 201-219/11

WELL DONE

FLT. LT. KENNETH A. HARVEY, RCAF

DEFENSE SUPPLY AGENCY, DETROIT, MICHIGAN

Flight Lieutenant Kenneth A. Harvey was returning to base during the test flight of an F-84F. About ten miles from base at 5000 feet, the engine started to bang and vibrate violently. The tailpipe temperature went to 800°C and continued climbing; engine RPM fluctuated between 50 and 85 per cent. Lieutenant Harvey declared an emergency to the tower at RCAF Station Namao and said he would land downwind since that was the closest runway.

Suspecting bearing failure, Lieutenant Harvey selected a power setting of 87 per cent to give longer engine life because, if the engine could be kept running, he would have sufficient power for the landing pattern without making further use of the throttle.

The vibrations became worse and at about five miles from the runway the engine seized. He immediately pulled the throttle back to the idle position, selected Emergency Hydraulics, hit the airstart switch and selected Emergency fuel ON, trying for a relight. Receiving no response, he selected fuel lever OFF, throttle OFF (the gear was already down), and made a successful landing. Immediately after touchdown, he deployed the drag chute and switched off the battery.

Lieutenant Harvey did not eject because he was so close to a highly populated area and could not bring himself to leave an aircraft under those conditions.

At the time of the incident, Lieutenant Harvey was a test pilot for Northwest Industries, Ltd., a Canadian firm performing IRAN under a United States Air Force contract. Although Lieutenant Harvey's flying time in the F-84 was very low, his skill in averting what might have been a serious accident resulted in the possible saving of lives and the aircraft. WELL DONE! ★

PHOTOGRAPH BY MSGT. BOB PARKER

29.1305
LYS

AEROSPACE

SAFETY

UNITED STATES AIR FORCE

SEPTEMBER 1966

COMMAND CONTROL . . . SEE PAGE TWO

AEROSPACE
SAFETY

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AFRP 62-1 VOLUME 22 NUMBER 9

Fallout

FAMILIAR FACE

I thought the face looked familiar as I read the "Well Done" salute to Capt James D. Johnson, 4510th Combat Crew Training Wing, Luke AFB, Ariz. (Inside Back Cover, July issue.)

Then I remembered that this is the same officer (a Lieutenant then) who had bailed out of a stricken B-26 over South Vietnam on February 6, 1963. He spent a few days in the thick jungles before finally reaching a clearing where he was spotted by flying mates who sent a chopper to his rescue. (The story appears in "Air Escape and Evasion," a book edited by Lt Col James F. Sunderman, USAF, and published by Franklin Watts, Inc.) I interviewed (then Lt.) Johnson at Tan Son Nhut Airfield the day he was returned to safety. Colonel Sunderman and I were there on Tdy at the time.

Evidently Captain Johnson has cultivated a good habit—staying calm and doing the right thing when the chips are down.

Congratulations on another fine issue.

MSgt James A. George, USAF
Staff Writer, The AIRMAN Magazine

Thank you for this story.

To The Editor, IPIS Approach

Reference your article on types of procedure turn depiction (May issue AEROSPACE SAFETY), I should like to vote for the holding pattern depiction. During four years of teaching instrument procedures in a Combat Crew Training School, we have weathered many changes in procedures for holding patterns and low altitude procedure turns. Our experience has shown that for a procedure to be easily learned, it should be kept as simple as possible.

The holding pattern type of portrayal helps to keep AFM 51-37 procedure turns as simple as possible. Of the three types of portrayals it best depicts the basic information neede to perform any of the recommended turns This includes the depiction of the inboun course, the outbound course, and the maneuvering side.

The barbed type depiction is an adequat presentation, as it also gives a good picture o the inbound course, the outbound course, an the maneuvering side. However, the barbe depiction requires a little closer scrutinizatio to ascertain these details than does the holding pattern type.

The teardrop depiction is entirely unsati factory. This type appears to represent a required, or at least a desired type of procedure turn, instead of just presenting sufficie data to perform any of the recommended procedure turns in AFM 51-37. It cannot be standardized, as recommended teardrop course differ for aircraft with different pattern speed The teardrop depiction does not portray th outbound course or the maneuvering sid nearly as well as the other two types. Whe a type of turn other than the teardrop is t be accomplished, it may require more tha just a glance to determine which side is th maneuvering side. The vertical profile on th teardrop depiction may be of little assistanc and, in fact, may be a hazard as presentl used. If it calls for a "Right Turn," this d

continued on page 28

Who's concerned about SAFETY?

Every agency of the United States Government from the executive down through all departments is very concerned about safety. In fact, just about every business is concerned about safety. So are our insurance companies. I think YOU are concerned about safety; I KNOW I am.

Government agencies are so safety conscious that offices have been established to promote safety throughout the individual departments. Industry spends vast sums of money to promote safety. Population centers throughout the country do all they can to make safety a byword. Insurance companies certainly spread the word by giving us lower rates if safety requirements are met.

Why is it so many do so much in the interest of safety?

The answer, basically, is with you and me. Why? Because we are humans—Homo Sapiens—the weakest link in the chain. Our country can design, fabricate, and manufacture just about any item that is required for any particular function. And we can do it so the end product is almost "goof proof." And, right there is the rub. ALMOST "goof proof."

Great strides are being made by the top thinkers in this safety business. They have taken one brainchild, System Safety Engineering, and integrated it into the design phase of new products. The Legislative Branch of our government does much to encourage "built-in" safety in many industrial outputs. The Executive Branch of our government has lent the prestige of that office to a safety program, Project Mission "Safety 70."

At this point, let's stop and drag out that overworked word, "analyze." If we analyze why all this talent and money is being expended on safety, we immediately get back to the basic problem. You and I. Humans . . . The old adage "To err is human, but to forgive is divine," is a philosophy that points out the weak link in the chain. The humans—you and I.

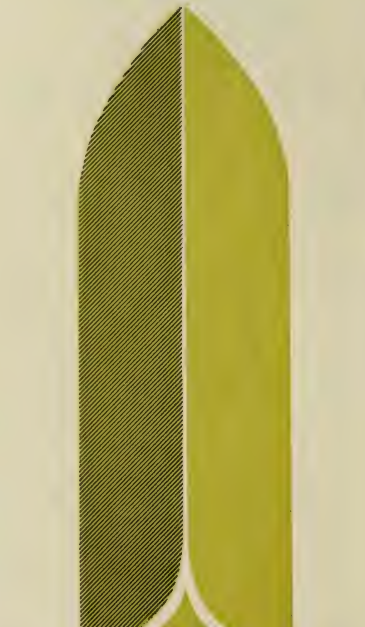
We have the technology to determine from telemetric data what caused a space-launch failure. We can predict within seconds when a space probe will pass a planet. We can sustain life in earth orbit. We can do things today that 20 years ago were dreams of a visionary few. But, we still can't determine human reaction to a given situation or predict when a human is going to err.

So, all of these people are spending their time and all this money to try and make you and me stop and think. To think SAFETY. To stop doing things that lead to accidents. To believe in safety. To do our job, any job, safely. To look for ways of doing these jobs in a safe manner.

With all the emphasis on Safety, there must be something to it. I am convinced and concerned about safety. How about you? ★

Lt Col C. N. Mozley
Directorate of Aerospace Safety

COMMAN



A recent announcement involving Air Force-wide C-130 accident experience provides an important lesson directly applicable to any flying operation. It is necessary that we examine it closely.

From 1 January 1965 through 1 May 1966, there were 16 C-130 major accidents in the Air Force with eight aircraft destroyed and 35 people killed. This represents 39 per cent of all C-130 major accidents since the aircraft entered USAF inventory in 1955. More significantly, the primary cause of 12 of the 16 accidents was pilot factor. Some of the specific causes listed were immature judgment, poor technique, and lack of professional attitude. In one case, the pilot deliberately violated operating procedures and exceeded design limitations of the aircraft while attempting to perform an exhibition takeoff. He and the five other people aboard were killed. The accident board uncovered a background of similar actions by this pilot.

In another accident, the aircraft commander attempted takeoff with a known engine malfunction. In a third case, seven crewmembers were killed when the pilot attempted a landing with weather below landing minimums. The other accidents have similar stories.

The Air Staff is of course deeply concerned over this drastic increase in accidents. They have recommended a "searching review of aircrew command and control procedures, quality of aircrew training and exact adherence to standards and highest professional attitudes."

This is certainly the right direction for corrective action. Specific actions needed to correct such a problem, however, may not be quite so evident. It is interesting to note the Air Force position that this rash of accidents "cannot be attributed to a decline in aircrew experience but an apparent disregard for well-founded procedures and complacency on the part of aircrews."

This is saying that the aircrews know better but are doing it anyway. The next logical question is, why? The Air Force message outlining the problem

CONTROL

states "inadequate command and control" is one of the cause factors. I will carry this further and opine that most of the cause is inadequate command control.

Both "inadequate" and "misdirected" command control can lead to disaster. If policies and procedures are ill-defined and loosely managed, a confused jumble of operating methods appears. This is fertile ground for accidents. By contrast, sound supervision will always lie at the heart of an efficient and effective organization.

USAFE's position on command control is clear and firm. It has been stated many times through various channels. However, it is important that we continually emphasize the policy because it is the very philosophy by which we operate.

Command control in USAFE involves concise steps and is applicable at all levels of command and supervision. First of all, we must exactly define duties and rules of operation. The rules must be tailored to the needs of our mission. There must be only one set of rules and one standard, as opposed to a set of written rules with empirical procedures.

Second, we must make certain that all our people understand, without confusion, all the rules. Especially must they understand that rules and procedures are dynamic tools of operation. If any rule or procedure is unrealistic, it should be challenged; and if found wanting, changed. We must encourage our people constantly to examine the way we do things to insure it is the best way.

The philosophy is simple. It can be expressed in these objective words: "That all tasks be accomplished in accordance with prescribed standards and that all personnel take pride in ensuring such accomplishment." Commanders and supervisors at all levels must be dedicated to this philosophy and to the three-pronged creed for its pursuance and realization:

- Maintenance of clear procedures,
- Assurance of their understanding,
- Exemplary leadership. ★

Since this article was written, General Bruce K. Holloway, the author, has moved from Commander of USAFE to Air Force Vice Chief of Staff. His command experience, from tactical units to STRIKE Command and Commander of USAFE, lends impact to his remarks on Command Control.

HEADS OR TAILS

must we bust 'em?

Maj Richard M. Chubb, M.C., USAF
Medical Officer, Life Sciences Div

The early USAF experience with the F-4C ejection system has been considerably less successful than we had reason to believe it would be. Too many people have been ejecting at unreasonably low altitudes and too many backs have been broken in otherwise successful ejections.

Let us consider the most serious problem first. It makes no sense whatsoever to expect an improved ejection system to do the impossible. Certainly, the F-4C system, because of its positively deployed parachute and a slightly higher boost capability, gives you better low-level capability than some of our other ballistic systems. This small gain in time for chute deployment and altitude of trajectory, in level flight, is definitely not enough to significantly increase your chances of recovering an aircraft you are about to lose. Therefore, you should never allow the relatively small increase in escape capability to sucker you into riding a dying beast to an unreasonably low altitude or into a high sink rate. It appears quite possible that a few of our men have done just this. A grim lesson we have learned is that new escape systems initially have the worst success rates—just because people put them to a more severe test.

The increased low-level capability was put into the system to help the hapless jock who finds himself in dire straits at low altitude, without the capability to gain altitude or improve his ejection chances in any other way. It was not intended to promote lower escapes from high-altitude emergencies. This same principle applies to some of our other aircraft that will soon have rocket boosted seats, positively deployed chutes, and other low-level improvements. If pilots equipped with these systems get overconfident about their ability to escape, some will not live to regret it. If your emergency at altitude is such that you should eject, don't let a good low-level escape system kill you. This is certainly not intended to discourage efforts to recover an aircraft in difficulty. On the other hand, there is no future in staying with a lost cause just because your escape system has an advertised capability to recover you at a lower altitude. You must remember that the slightest delay or malfunction can eliminate the advantage of the better system.

Now for another problem. A compression fracture of the spine is a major injury, although not necessarily disabling. Some persons, in fact, would not have known of their fractures had "routine" x-rays not been taken. Others have definitely been disabled. Few, if any, have lost flight pay because there is a three months' excusal for injuries incurred in an aircraft accident. The vast majority are back to flying well before this three-months has expired.

The fact that most of these compression fractures are relatively benign is no justification for ignoring them. Everyone who ejects should have his spine x-rayed if at all feasible. This is because a relatively minor fracture in one ejection could lead to a severe fracture if another ejection should occur before it is healed. (We have already had one man eject twice from the F-4C). The flight surgeon will ordinarily ask you if your back hurts and this is no time to be stoical — if there is so much as a twinge, tell him.

Now, why do some people fracture their spines while others do not? One Navy study showed that a system similar to that of the F-4C caused compression fractures in over 30 per cent of ejections when the man ejected through the canopy, but in only five per cent when the canopy was jettisoned first. An Air Force study showed that the vast majority of those who fractured their spines were out of position. These two facts are almost certainly related. It is difficult to envision anyone so stoical as to be able to sit erect when he knows he's going through the canopy — you can bet he'll flinch.

It appears highly probable that the primary factor in ejection fractures is forward bending (flexion) of the spine. Anything that causes the head to be forward of the axis of the spine will start this forward flexion. With the onset of high G forces, the neck muscles are unable to hold the head up. In addition, the weight of the head transmitted through these muscles to the bony protuberances on the back of the spine will start flexing the spinal column. In addition, some of the support for the forward wall of the chest is lost, and it tends to sag more easily. The net result is a bowing of the spine that usually results in compression of the forward wall of the vertebrae in about the middle of the back. This area usually ranges from the middle of the chest down, and will be determined by a number of factors not precisely understood and not particularly important to you.

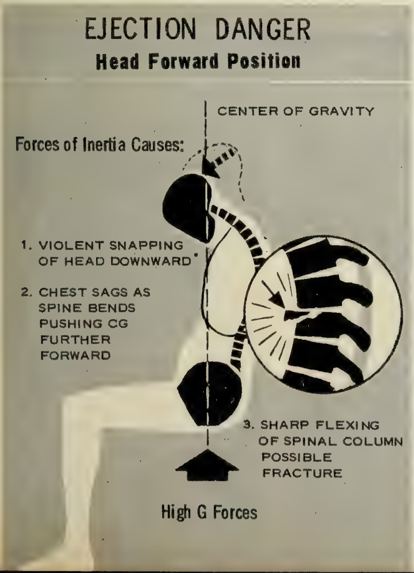
The solution is to sit absolutely erect. If you do this, your chances of receiving a spinal fracture are indeed remote. Those of you who ride the F-4C know that if you put your back against the seat, the headrest holds your head forward. You must, therefore, either use a pad to hold your back forward or consciously come to a brace as you pull the D-ring or face curtain. (A recently developed lumbar pad is being supplied to F-4C crews. It was designed to provide support to the spine both for reducing injuries during ejection and for more comfort during flight.)

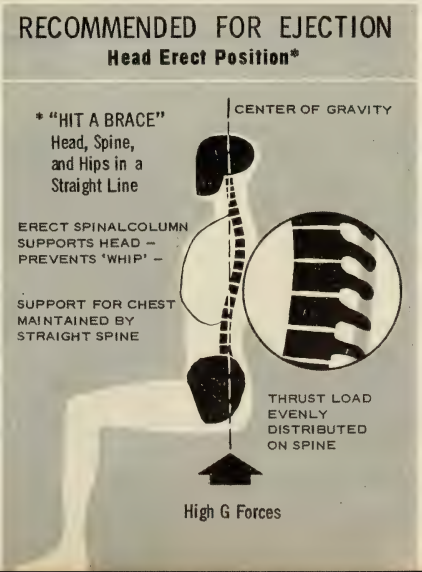
There's a lot of scuttlebutt about more fractures with D-ring usage than with face curtains. The fact is that, of 22 survivors of ejection from F-4Cs, 16 used the D-ring and six used the face curtain. Five who used the D-ring received compression fractures and three who used the face curtain got them. These are rather small numbers to support big statements; they are reduced further by the fact that one of the eight fractures very possibly occurred during parachute landing, because the man landed very hard on an undeployed survival kit after initiating ejection with the face curtain. It is obvious that you can and must assume an erect position, no matter which ejection actuation device you use.

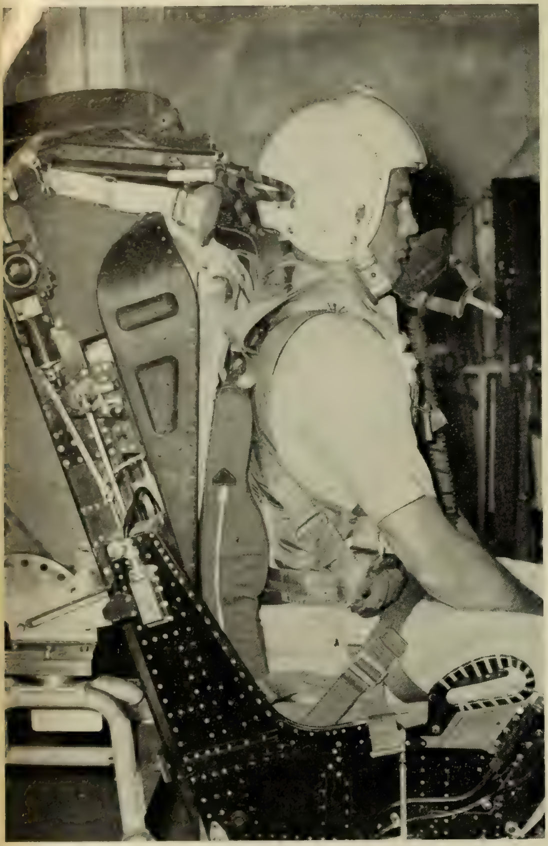
In summary, here are some simple rules to follow:

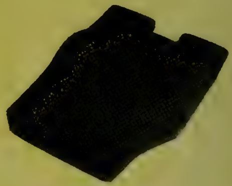
1. Know the capability of your escape system, considering airspeed, altitude, attitude and sink rate.
2. Never let a new or improved escape system cause you to delay your ejection by overconfidence in its capabilities.
3. On the other hand, in a very low level emergency, use your escape system any time the bird is hopelessly lost and you are within the limits you've established for yourself in Rule 1.
4. Sit absolutely straight when you eject. This requires practice of your ejection motions with all of the various actuation devices.
5. Release your survival kit before you hit the ground, water or trees. Practice while suspended in a parachute harness will help train you to do this.
6. Get your back x-rayed after an ejection. ★

More on page six


EJECTION DANGER
Head Forward Position
CENTER OF GRAVITY
Forces of Inertia Causes:
1. VIOLENT SNAPPING OF HEAD DOWNWARD
2. CHEST SAGS AS SPINE BENDS PUSHING CG FURTHER FORWARD
3. SHARP FLEXING OF SPINAL COLUMN POSSIBLE FRACTURE
High G Forces


RECOMMENDED FOR EJECTION
Head Erect Position*
CENTER OF GRAVITY
* "HIT A BRACE" Head, Spine, and Hips in a Straight Line
ERECT SPINALCOLUMN SUPPORTS HEAD — PREVENTS 'WHIP' —
SUPPORT FOR CHEST MAINTAINED BY STRAIGHT SPINE
THRUST LOAD EVENLY DISTRIBUTED ON SPINE
High G Forces





LUMBAR PAD

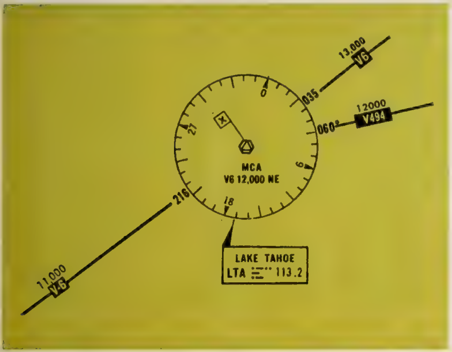
New lumbar pad for F-4C crews, above, and installed, left, should provide more comfort, reduce incident of back aches. In addition, it is expected to reduce the number of back injuries during ejection by providing crewmembers better support of the spine and aiding in proper alignment of the spinal column for ejection.

As lumbar pads become available, F-4C crews are encouraged to get rid of homemade or locally fabricated pads such as those shown at right. In the event of ejection these may cause misalignment of the spine.

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

Q (Refer to diagram) An aircraft is northeast bound on V-6 inbound to the Lake Tahoe VOR at 11,000 feet assigned altitude. In the event of two-way radio failure, when should climb be started?



A (U.S. procedure) Begin climb so as to cross Lake Tahoe at 12,000 feet, then continue climbing to 13,000 feet. What if the ATC clearance was V-6 Lake Tahoe V494 . . .? In that case maintain 11,000 feet until over the Lake Tahoe VOR, then climb to 12,000 feet since the Minimum Crossing Altitude (MCA) at Lake Tahoe applies only to V-6 northeast bound.

Q What is the minimum rate of climb when climbing from one Minimum En Route Altitude (MEA) to another?

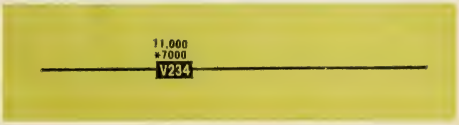
A MEAs are established using climb rates, as follows:

Sea level through 5000 feet—150 ft/NM
5000 feet through 10,000 feet—120 ft/NM
10,000 feet and over—100 ft/NM

Therefore, if you are changing MEAs above 10,000 feet and your ground speed is 180 knots, you must climb at least 300 ft/min. Can your aircraft hack this at a typical gross weight? How about with one engine out?

Q Why do some airways designate a MOCA (Minimum Obstruction Clearance Altitude) and others do not? Also, am I authorized IFR flight at the MOCA?

A (U.S. Procedure) An MOCA is shown on En Route Charts directly below the MEA and is identified by an asterisk.



The designation of an MOCA indicates that a higher MEA has been established for that particular airway or segment because of signal reception requirements. When no MOCA is shown on the chart, the MEA and MOCA are considered to be the same.

An aircraft may be cleared below MEA but not below MOCA provided the altitude assigned is at least 500 feet above the floor of controlled airspace along a designated airway, and:

- Nonradar environment—Aircraft is within 22 NM of a VOR, VORTAC or TACAN;
- Radar environment—Aircraft is being radar vectored and has been issued lost communication instructions. ★

Response to The IPIS Approach has been good, as evidenced by the many letters received, two of which are reproduced in the Fallout Section and on page 28. Both the IPIS and AEROSPACE SAFETY encourage letters, for they indicate interest in the feature and, of course, questions help to identify areas of doubt or concern that IPIS can shed some light on.

You may write to either IPIS or AEROSPACE SAFETY. Every attempt will be made to provide the latest info in response to questions. Ed. ★

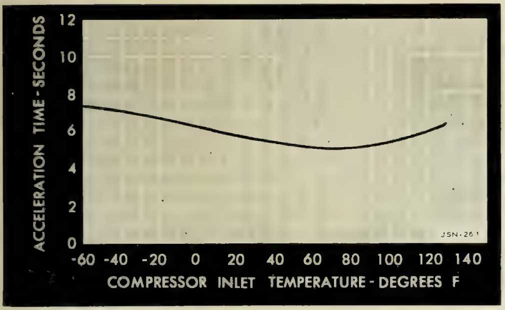
*Acceleration Time May Be Misleading

Reprinted from GE Jet Service News

Acceleration time for an engine powering a single-engine airplane, unless it is abnormally high, is not a particular problem because there is nothing with which to compare it. The story's different in twin-engine aircraft, however. One engine lagging the other by only a second or two may cause some consternation. Differences in time between uninstalled engines, installed engines on the ground, and engines in aircraft in flight may raise some doubts as to whether the engine is operating satisfactorily.

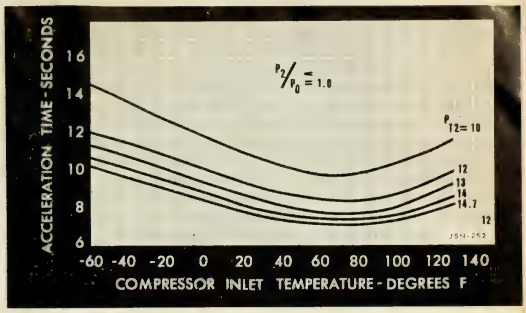
At the outset, let's emphasize and re-emphasize one important point: *Acceleration time for aircraft-installed J79 engines is not guaranteed.* Acceleration time for uninstalled engines tested according to Military Specifications is a guaranteed item. Certainly, however, installed - engine acceleration time should not be abnormally high.

Among those things which affect acceleration time are compressor inlet temperature and power extraction from the engine. Power extracted includes that necessary to drive airframe accessories through shafting in the accessory-drive section. Air bled from the engine to operate various aircraft systems is also power extraction. You can readily see, therefore, that such variables affecting engine operation make it next to impossible to guarantee acceleration time, except on those engines which are tested according to the guarantee specifications.



Acceleration Time

FIGURE 1



Estimated Acceleration Time

For Reference Only- Not Guaranteed

FIGURE 2

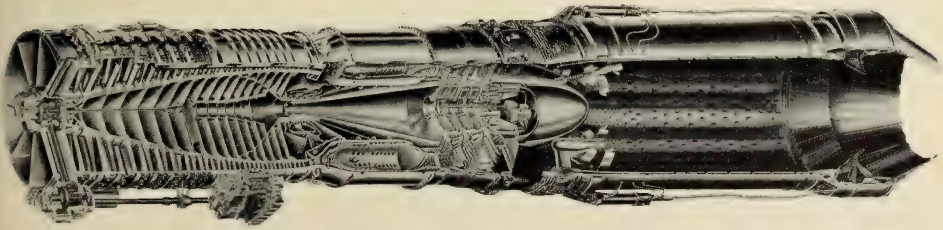
Shown in Figure 1 is a typical guarantee acceleration curve for an uninstalled engine operating under sea-level static conditions with no air being extracted from the compressor bleed ports. Acceleration time varies with compressor inlet temperature.

Changes occur when the engine is installed in an airplane, as you can see in Figure 2. This shows characteristic acceleration times for various pressure altitudes, but again with no compressor bleed. The curves follow the same general pattern as that in the guarantee curve; compressor inlet temperature still affects the acceleration time, but the time for acceleration is greater. If air were being bled, the acceleration characteristics would be changed even more.

Basically, the reason for the differences is simple and may be illustrated by comparing the airplane with the old family bus. A 6-cylinder automobile engine, tuned properly and driving a fan, water pump, and generator will perform quite satisfactorily. Equip that same automobile with an automatic transmission and an air conditioner and you'll note some startling changes, among which will be slower accelerations. It's the same old story of being unable to receive something for nothing.

Since the jet engine is designed to provide for power extraction, the changes are less startling than those in the foregoing example. Nonetheless, some minor changes will occur. Since two engines, side by side, are not identical twins, operating characteristics will vary slightly. So when accelerations in flight are slightly slower than those on the ground, and the time on one engine is a couple of seconds longer than its running mate, keep in mind that such differences are normal. The engines are operating satisfactorily and the power is there, even though it may take a second or two longer to reach its maximum level.

When measuring acceleration time, one must be certain to know when to start and when to end the timing. The time should be counted from the initiation of the throttle burst to the cutback of EGT, not to 100 per cent speed. In the test cell a correction is applied. Acceleration time of an aircraft-installed engine must also be checked during the same operating interval, but remember that even with the correction applied, the result is only an approximation. ★



Acceleration time is affected by compressor inlet temperature and power extraction from the engine. Don't be alarmed if acceleration time of one engine is a little slower than on the other — that's normal.

HOT BRAKES . . . NO BREAK FOR PERSONNEL

Martin P. Casey, SCMCM, Hq AF Systems Command

It is rumored that when General Custer saw all the Indians who attacked him at the Little Big Horn, he realized he hadn't gotten the word. In keeping an ear to the ground, we have been getting recent rumbles that some of our aircraft drivers haven't gotten the word about where to park the bird if they find themselves with either a brake fire, or smoking brakes, after putting it down on the airpatch. The Word, as put out some time back, was to the effect that you don't taxi up to the ramp and toss out the anchor after such an affair — rather, you picked out a predesignated chunk of unoccupied geography and deposited the bird there, whereupon you left the scene. Reason for this longer walk back to Ops was not on account of you liked fresh air and sunshine so much as you didn't care to have a subsequent tire/wheel explosion make holes in other aircraft, and Sam's pretty buildings, and people.

Lest any of the new arrivals think this is pure, improbable fiction, the history book contains all the gory details for how one troop at Kirtland, and another at Edwards found out the hard way that these explosions are sometimes fatal.

To make sure everyone is following the same script, let's run through the scenario once more, and consider two possibilities.

First is the case of an actual brake/wheel fire. Mindful that others might like to use the runway, the pilot, if he is able to drive on his wheels, has maneuvered the bird to a predesignated space, well away from other aircraft or buildings, which is where the fire department meets him. Obviously, if he can't move, he sits. The fire department responds and puts out the fire, using minimum quantities of water spray, CB, or CO_2 then they exit stage left, with all the other members of the cast (Maintenance, Ops, Air Police — the whole package) and the bird is left to cool in center stage all by itself. Again, once the fire is out, everyone leaves, and the aircraft cools itself — no fans, spray or anything else — for at least one-half hour, longer if there are high ambients.

The other possibility is that of a hot or smoking brake. It is possible for new brakes to smoke up pretty good on first application as the high spots burn down, but unless everyone concerned knows for sure that a particular aircraft is making its first landing with new brakes, any hot brake report should also be treated as a potential explosion. Again, the pilot drives to the predesignated hot-brake parking area, leaves the scene, and nobody does anything for at least half an hour.

In the "special conditions" category:

- If the aircraft tires are equipped with fusible plugs, the above problems don't exist. Explosions occur with high pressure tires on high-performance aircraft, usually.
- Most critical time appears to be in the first 15 minutes *after* the fire is extinguished, or the aircraft is parked. This is when the heat

build-up occurs, which both increases internal tire pressure, and causes the wheel to fail.

- Keep the area clear for at least one thousand feet. One incident indicated the exploding wheel traveled much farther than this.
- Remember the special procedure of using spiked planks for F-4s and the need of advanced coordination between the F-4 aircraft drivers and the firefighters, since very few firefighters are checked out in taxiing F-4s. If you come up against a sticky situation with other types of aircraft, use the spiked planks there, too — a brake fire, or hot brakes will probably require a tire change anyhow.

It's possible that while your own aircraft operators are doing it by the numbers, perhaps some of your tenants haven't gotten the word about the potential bombs they may have under these circumstances. You Ops types might profitably do some campaigning around the boondocks, before some tenant parks his bomb on your ramp. This has happened; and while there have been no accidents, we don't like the odds against no accidents occurring.

Cue-words for you in directing your cast in this Oscar-winner are "predesignated areas" (by Ops & FlySafe); "put the fire out and everyone leaves"; "clear the area for at least 1000 feet"; "spiked planks for F-4s"; "Props" include marking up predesignated areas on a copy of the map of your airpatch and giving it to the people in the tower; the fire department will furnish the rest as needed. Your rehearsals will occur at your FlySafe meetings; your cast of characters won't require any actual walk-through but only need to remember to listen for directions when it's their turn in the spotlight. You might also show them a copy of the map you give the tower. And the theme of this mighty opus is "Play it cool, Clyde!" ★

Gen Hunter Harris, Pacific Air Forces commander-in-chief, praises Air Force men from the 416th Tactical Fighter Squadron after presenting the Colombian Trophy to Lt Col Richard M. Mischke, of San Antonio, Tex., 416th commander, at the Bien Hoa Air Base. The trophy is given to the Air Force tactical fighter unit having the lowest aircraft accident rate during the preceding year. Pilots of the 416th flew two years without an accident, including more than 4800 hours in combat over North and South Vietnam.

The trophy—a silver cup supported by coiled serpents on a mahogany base—was first awarded by the Republic of Colombia in 1936.

COLOMBIAN TROPHY

The Colombian Trophy is awarded to the 416 Tactical Fighter Squadron, Tan Son Nhut Air Base, Vietnam, as the tactical organization considered to have had the most meritorious achievement in flight safety among the winners of Flying Safety Plaques for 1965. The 416 Tactical Fighter Squadron has compiled more than 16,000 hours in F-100D and F aircraft during the past two years without an accident. The unit maintained constant readiness as a vital part of the strike force in the Far East. The Squadron has participated in several full scale deployments. Unfamiliar terrain and facilities, adverse weather, short notice reaction, and hazards of combat failed to deter this Squadron in the professional accomplishment of its mission. The accomplishments of this Squadron required outstanding professionalism of each pilot and ground crew member, the utmost in training and proficiency, the highest caliber of leadership and supervision, and unsurpassed loyalty. The safety achievement of the 416 Tactical Fighter Squadron perpetuates the highest tradition and standards established for the Colombian Trophy and reflects great credit upon the 416 Tactical Fighter Squadron, Pacific Air Forces, and the United States Air Force.

F-100 ASIP*

AIRCRAFT STRUCTURAL INTEGRITY PROGRAM

The F-100 was produced with a designed service life of 3000 flying hours. At the present time, the fleet average is approximately 2300 hours. The decision to retain the F-100 within the force structure past its original phaseout point created a need for examination of the condition of the F-100 structure.

Airplane Structural Integrity Program (ASIP) requirements were set down by the USAF for the purpose of promoting, evaluating and substantiating the structural integrity, both in static strength and fatigue life, of new airplane systems for an established service life. The first model of the F-100 series, the F-100A, was designed in 1952, long before the ASIP requirement, and although fatigue was an important consideration when the F-100A and subsequent models — F-100C, D, and F were designed, no requirement existed for a specific fatigue life.

To this date, F-100s have been relatively free of major airframe structural fatigue problems. However, Air Force plans for continued usage of the airplane have resulted in this venture to determine the need for, and extent of, structural modification to attain an established service life goal of 5500 flying hours. A contract, monitored by the Sacramento Air Materiel Area, was let to North American Aviation to perform this engineering investigation.

The program consists of the following three phases, the completion of which is intended to provide a trouble-free structural capability for F-100 aircraft through their planned service life:

- A *"Lead-the-Fleet Flying Program"* where flight loads, ground loads and in-service failure data will be collected on a large scale. These data will establish realistic fatigue loading spectra based on current usage for major airplane components, and will be the basis for the fatigue anaylsis and repeat load test programs to locate critical fatigue areas in the airframe.
- A *"Design and Analysis Program"* where critical structural fatigue areas will be identified, specimens tested and modifications developed.
- A *"Full Scale Fatigue Test Program"* where both unmodified and modified major structural components will be tested.

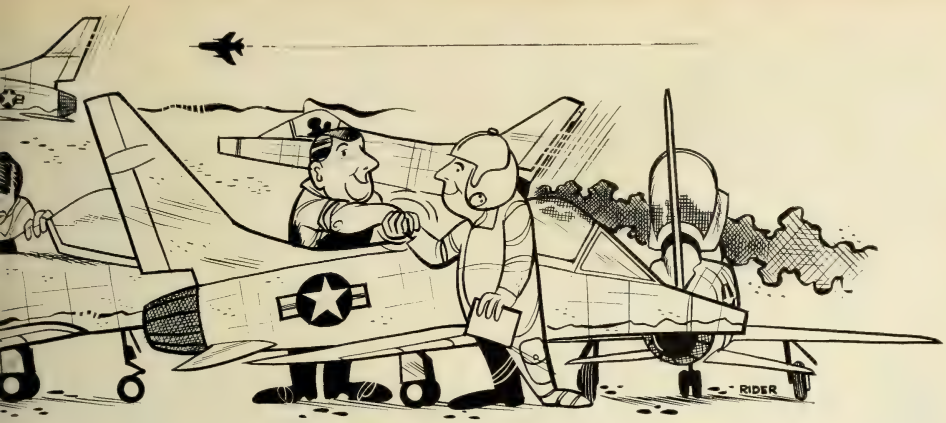
PHASE I

The first phase, "Lead-the-Fleet Flying Program" is fully covered in T.O. 1F-100-9, dated 3 March 1966, changed 7 April 1966. Briefly, this phase involves accelerated flying with two basic objectives:

(1) To collect flight load and ground load data necessary to establish realistic fatigue loading spectra on four major airplane components — wing, fuselage, vertical stabilizer, and landing gear; reduce these spectra to practical laboratory fatigue test loading schedules for use in Phase III of this program and provide flight data to continuously update these load schedules based on current usage of the F-100 fleet.

(2) To collect in-service failure data that will be used to confirm the design, analysis and test results of Phases II and III; and locate further critical fatigue areas in the airframe requiring inspection, modification, and interim repairs to extend the service life of the airplane.

In Phase I, one hundred and twenty-two aircraft will be used to collect the necessary data. Twenty-two of these will be known as "Lead-the-Fleet" airplanes and will be used to develop air loads data and in-service failure data. These aircraft will be flown at a rate twice that of the normal programmed rate. Four of the 22 will be specially instrumented F-100Ds with digital recording systems and will be identified as "Yankee I" and "II" (fully instrumented) and "Yankee III" and "IV" (partially instrumented) airplanes. The other 18 airplanes will be equipped with a 10-level statistical accelerometer



instrumentation system and will be identified as "X-Ray" aircraft. One hundred airplanes, including those flown by *Thunderbirds* F-100 precision demonstration team, will be known as the "Fleet Control Group" and will likewise be equipped with the statistical accelerometer instrumentation system. Identified as "Zulu," these will be used to obtain a comparison of fleet usage to that of the "Lead-the-Fleet" group and will be flown at a normal programmed rate.

Instrumentation for "Yankee III" and "IV," "X-Ray," and "Zulu" airplanes has been installed by T.O. 1F-100-974. Phase I data requirements consist of tapes of recorded data from four "Yankee" airplanes and two forms, 1F-100-9WS-1 and 1F-100-9WS-2, in two parts each. T.O. 1F-100-9 explains how to fill out and use the forms. Inspection areas and requirements are detailed in SMAMA Engineering Report NE 66-301. This report should be used in conjunction with Form 1F-100-9WS-2. A description of Project "Lead-the-Fleet Flying Program" and instructions for the pilot are contained in T.O. IF-100D(I)-1S-24, dated 5 April 1966. This is an operational supplement to the Flight Manual, T.O. 1F-100D(I)-1, dated 15 May 1964, changed 31 July 1965. Other Technical Manuals affected by the F-100 ASIP are as follows: 1F-100D(1)-2-7; 1F-100D(I)-2-10; 1F-100D(I)-4; 1F-100F(I)-2-7; 1F-100F(I)-2-10; 1F-100F(I)-4; 1F-100A-6.

PHASE II

This phase is concerned with airframe fatigue analysis. In Phase II, fatigue tests of small elements representing critical areas of the structure will be made to supplement the analysis. Also included will be designs of modifications to improve the fatigue life of possible critical areas. The analysis is a vital process to determine the correct modification action required when the fatigue life has been demonstrated (by test or in-service failures) as inadequate. The Phase I inspection data on the "Lead-the-Fleet Group" is important to this phase of the program.

PHASE III

The fatigue load spectra derived from Phase I will be used to prepare a laboratory loading schedule to perform full-scale cyclic tests of the wing, fuselage, vertical stabilizer and landing gear. Tests will be made on two complete wings, one complete fuselage and one aft fuselage with vertical stabilizer. As the program proceeds, modifications developed in the Phase II program will be incorporated and tested on some of these major components.

The results of all three phases of the F-100 ASIP will be summarized in a final report in which recommendations will be made to SMAMA on the ability of the structure to attain the usage goals set for F-100 airplanes. Where critical areas are found, design proposals for modifications will be submitted, and repair, maintenance and inspection procedures will be recommended.

Well, that's the ASIP in a nut shell — a short look at a long program that will bring many more successful operational years for the Century birds. The success of a program of this nature, however, depends largely upon two things: the proper completion of the correct forms and the prompt return of the completed forms. This responsibility lies with the pilot, the maintenance officer, the crew chief and the armorer. So don't get caught in short supply. Order a sufficient quantity of -9WS-1s and -2s now, before you need them, from SMAMA (SMNEA / F-100 Aircraft Structural Integrity Program Engineering), McClellan AFB, California, 95652. Send the completed forms, along with pertinent sketches, photographs, samples, etc., to F-100 Project Engineering, North American Aviation, Inc., International Airport, Los Angeles, California, 90009. ★

Rex Riley CROSS COUNTRY NOTES

AFTER COMPLETION of a 100-hour periodic inspection, an O-1E was flown for one hour during delivery to a South Vietnam base. After the flight the pilot wrote up the aircraft for a low vacuum reading. Next day the engine was run up to determine the cause for the low vacuum and it was discovered that both mags showed the maximum allowable drop. This was corrected by adjusting the fuel mixture. When an attempt was made to adjust the throttle linkage, the mechanic found that the throttle cable housing was broken at a point where the solid tubing portion joins the flexible section just aft of the carburetor. Someone had repaired the break by wrapping electrician's tape around the broken area. The throttle cable inside the housing was kinked which caused the throttle to bind and prevented the carburetor throttle plate from reaching the full open position.

Rex has heard his share of tales of the barnstorming days when impoverished pilots held their machines together with spit and bailing wire, and even egg whites. But that was 40 years ago. Whoever made the throttle cable housing fix with tape lacked only one thing—judgment.

DURING A NIGHT FLIGHT the left engine of a C-119 began backfiring severely and the carburetor air temperature went to 50°C. Rich mixture did not help, so the power was reduced to idle and the backfiring stopped. When power was increased and the engine began to backfire again, the engine was feathered. Then the right engine began to run rough and low torque made it difficult to maintain altitude.

At the time these difficulties appeared, the aircraft was on the far side of a metropolitan area from home base, so the pilot decided to land at a civil airport rather than risk flight across the city. The landing was successful.

Cause of the left engine trouble was a broken rocker arm; fouled plugs were suspected as the reason for the right engine acting up.

Here was a crew that acted wisely and didn't succumb to that urge to get back to home plate. If they had, the outcome might have been different and Rex might be telling you about an accident instead of a minor incident.

WHERE TO KEEP IT—We have had a couple of cases of unnecessary hypoxia caused by two things: a poor oxygen system preflight done in haste and a practice of leaving the CRU-8/P or CRU-60/P oxygen connector on the parachute instead of on the mask. Although the personnel involved were conscientious, and closely followed the checklists, they forgot to hook up their mask hoses. If you follow this procedure you eliminate the disconnect warning device that is built into the connector instead of the mask hose. A good PRICE check would have caught this. A recent field trip found that this procedure was causing undue wear, broken male mask hose connector prongs, and permitting dirt and dust to collect in mask hose. The connector should remain on the mask hose end to prevent similar occurrences.

Maj George C. Braue
Life Sciences Division

ALAS.... POOR YORICK!

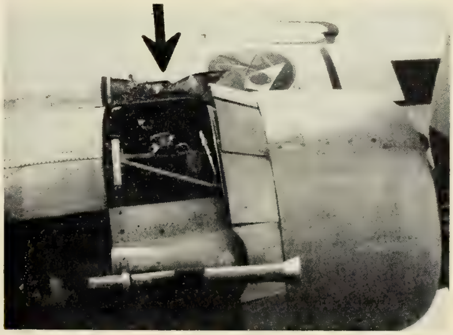
A RECENT LETTER from the Wing Safety Officer at a USAF base told of a foreign naval officer who was fatally injured when he ran into a turning propeller. The transport, owned by his country, was preparing to leave the base and the engines had been started. As the transient crew prepared to direct the aircraft from its parking spot, the officer arrived in a car and made a dash for the airplane.

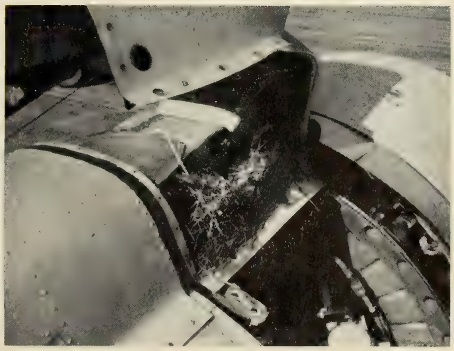
As the man approached from the right front, he was waving at the pilot and did not hear or see the transient alert man who, from his position outboard of the left wing, shouted and started toward the officer as he approached the aircraft. The pilot saw the approaching man and cut all four engines but the officer ran into the Nr 1 propeller.

BIRDS HAVE LONG demonstrated that they are persistent; now proof of their ingenuity is shown in the accompanying photos supplied by Captain Robert E. Maupin of Detachment 4, 2223d Instructor Sq (CONAC), at Chicago-O'Hare Int'l Airport.

In order to build the nest in the location shown, the birds had to enter the wheel well, fly over the oil cooler, entirely through the accessory section and over the carburetor air duct.

According to Capt Maupin, the aircraft (a C-47) had been in phase inspection the previous week but had made at least one flight with the stowaways aboard. The incubation period for sparrow eggs, he says, is about 14 days. The trouble with birds is that they haven't learned to keep their mouths shut. It was their chatter that led to their discovery. Otherwise, no telling how long they would have been able to maintain residence since access to that particular part of the engine cowling is seldom required. ★





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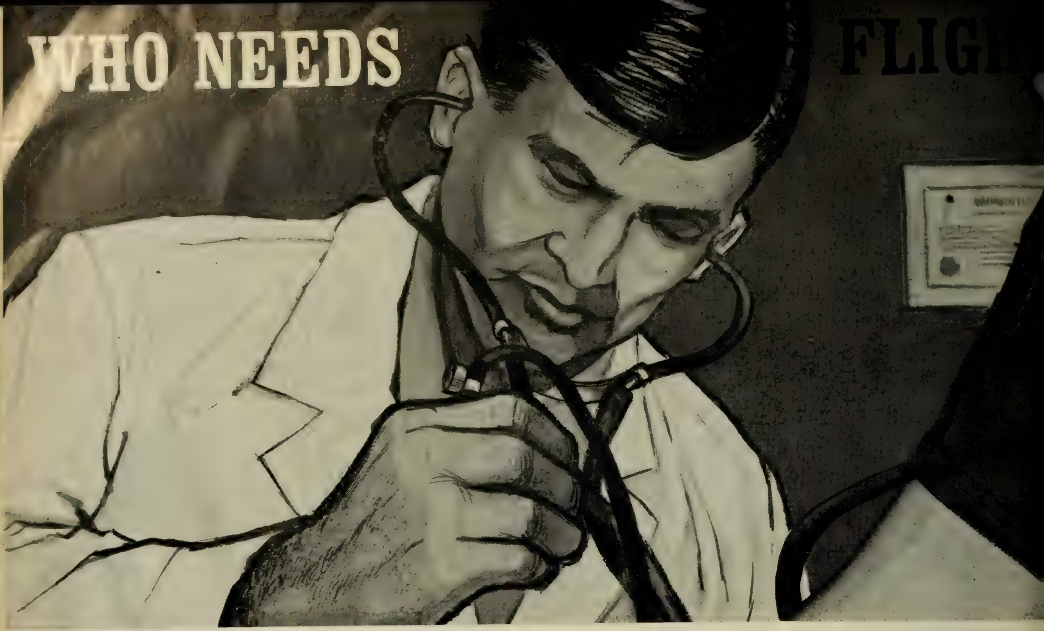


Maj Richard M. Chubb, M. C., USAF Medical Officer, Life Sciences Div

Nearing the end of a three-year hitch in the Life Sciences Division here at Norton, I can look back over ten years as a Medical Officer with the Air Force. During this time I have had too much experience with pilots who either wanted to treat themselves, tell the Flight Surgeon how they wanted to be treated, or to see other physicians who would give them what they wanted.

It is certainly understandable that a professional pilot doesn't want to jeopardize his career by telling his Flight Surgeon something that may get him grounded—perhaps for good. On the other hand, it makes no sense at all for a man to deliberately jeopardize his life, the lives of others, and expensive equipment by taking a chance that his illness will not cause an accident.

It was during my first month as a Flight Surgeon that I grounded a pilot with a case of severe tonsillitis and prescribed penicillin shots twice daily. On the second or third day, he was showing signs of improvement and talked me into ungrounding him so that he could take a flight to Tokyo and back. On the surface, there seemed little danger that his tonsillitis or the penicillin shots would cause him to have an accident. He was able to clear his ears, he could see well, he certainly had lost none of his muscular coordination. In short, I felt fairly secure in the belief that I had not made a serious error in ungrounding this pilot.

Then, two things happened. First, the pilot returned and told me in great detail how the soreness in the seat of his pants and in his throat had distracted him throughout his long journey. He admitted that he believed he should not have gone. The second occurred a few days later when I was MOD. That night a patient called to say that he had a penicillin reaction in the form of a rash that had appeared two weeks after his shot of long-acting penicillin. Medication he had gotten at the clinic helped the rash, but he was now complaining of severe pains in the knees and elbows. I didn't believe that these were associated, but there was a chance that the joint pains were a signal of an impending collapse as part of an allergic response to the penicillin. I told him to come in so I could have a look at him. I just happened to be in the reception room when he came through the door and collapsed in my arms from his delayed penicillin reaction. I don't need to draw pictures for any of you pilots about what could happen if you had a pencillin reaction like that in the midst of a long overwater flight in a single seat fighter. An explanation as to why you had taken penicillin would be the least of your worries.

I had another pilot tell me during his routine annual physical that his old ulcer had not bothered him for years. He had collapsed from a hemorrhage from it several years earlier. We'll skip the details and say only that a rather thorough investigation revealed that he was probably involved in a "little white lie." Not only had it bothered him, but he was taking medication for it

SURGEONS ?

YOU DO

and he was seeing a doctor down town. X-rays taken in a civilian hospital showed the same obstruction at the outlet of his stomach that our x-rays showed. There was no recommendation for waiver for this man who deliberately concealed an extremely serious condition, for which he was taking drugs that had a pronounced effect on his eyes.

On the other hand, there was once a pilot who developed asthma as the result of a very specific and local pollen. It bothered him only on certain days, and by mutual agreement between his Flight Surgeon and Commander, he was permitted to fly on his good days and take medicine on his bad days. This was strictly illegal, according to the letter of the law, and perhaps even the spirit of the law. This man is today an outstanding safety officer and his former Flight Surgeon says he has no regrets over breaking the law, because both he and the man's CO were absolutely sure that this particular pilot could be depended upon to do as he was told and not fly when he shouldn't. The man who conceals his illness cannot give this assurance that he won't have to fly while taking medicine.

Let's consider another aspect of this problem. A pilot had an illness for which he was taking medication that absolutely precluded giving him permission to fly. He dutifully reported to his Flight Surgeon and was properly grounded while TDY far from home. Within 24 hours, he was back with the unused portion of the medicine and the statement that he now was cured. After an apparently safe interval, to allow the medication to wear off, he was allowed to fly home with the rest of his outfit. He had an accident; there is still some suspicion that this was related to his physical status, although this certainly cannot be proven. It is interesting to note that the pilot had taken precautions to obviate disastrous effects should his illness recur in flight, indicating some lack of confidence on his part that he was really cured. This would appear to be a real case of get-home-itis-in-spite-of-gastroenteritis.

Then there was the fighter jock who had a "cold." It wasn't bad enough to keep him from flying, but he took a little anti-histamine and nose drops. We'll never know for certain what caused his death on that dark night. It is definitely known that, on previous occasions when he had experienced an ear-block on descent, he had become extremely dizzy and had been unable to see for several seconds until he cleared his ears. He had taken the nose drops supposedly to preclude just such an ear-block on his last flight. Was it his fault for not telling his Flight Surgeon about his problem, or were his squadron buddies who knew about his condition partly to blame? They all seemed to agree in testimony before the accident investigation board, that his problem could have caused the accident. One of them went so far as to admit that he had similar symptoms when he had an ear-block. There was no evidence that the medical member of the board

Author writes prescriptions for pilot. See your flight surgeon for proper medication. Don't rely on home remedies, off-the-shelf pills.

grounded the second pilot. I trust, however, that he did have a long heart-to-heart talk with that pilot. We'll never really know whether it was the medicine, the illness, or either, but we'll always be suspicious.

We had another fighter jock who went in for unexplained reasons on a dark, dark night. The board had actually finished its deliberations before one of the members discovered from the widow that this fighter pilot had had an unexplained loss of consciousness on at least one occasion shortly before his fatal accident.

That brings to mind some of the cases of heart attacks. Face it, a lot of you men are not as young as you once were — neither am I, for that matter. Some of us are going to have heart attacks and some of these will occur in flight —some already have.

About a year ago, one did. The victim was still conscious and able to conceal severe pain and feeling of ill health from the copilot. He felt so bad that he didn't want to exert himself enough to go back and look out the window at a faulty engine. He sent the copilot back to do that while he flew the airplane. I don't think I need to dwell on how severe the lack of judgment was in this case. We had another who tried to hide his coronary. It was only because those who helped him out of the plane insisted that he went to see the doctor.

I could tell you about one officer who insisted to his dying day that he had not had a coronary, even though his electrocardiograph showed positive evidence of an old, healed myocardial infarction. The autopsy confirmed it, and only then did one of his friends volunteer the information that this man had collapsed on the street, had been carried into a civilian hospital, and had stayed there 30 days on "ordinary leave."

It would be relatively simple to make up a list of drugs you could take and drugs you shouldn't if it were not for one little hooker — many of us react differently to many different drugs. Some of us are extremely sensitive and some of us can tolerate large doses of different drugs. One widely used appetite depressant is a prime example. Some people are greatly stimulated by it and call it a "go" pill; it puts other people to sleep. Some people lose their appetite with it, others eat even more. Some drugs that seem not to affect you much when taken alone are dangerous when other drugs are added. This is due to what we call potentiation — a condition where a combination effect seems to be greater than the additive effect of the two substances. Alcohol and barbiturate are classic examples. Certain tranquilizers probably fall into the same category. To be safe, your reactions to drugs must be thoroughly evaluated. Even more important, it must be determined that the illness for which you take the drugs is not one that will jeopardize the safety of flight.

I do not know which one of the categories mentioned in the first paragraph you fall into, but I'll bet a couple of cool ones that some time in your flying career you'll deliberately deceive your Flight Surgeon and unnecessarily risk your life to make a buck or two. I can understand your feelings, but I cannot condone them. There are many of us around the Air Force who will lean over backwards to help you and keep you flying. In fact, many of us have. You will find that the Surgeon General authorizes the use of some pretty potent drugs, provided they are controlled by the Flight Surgeon and your reaction to these drugs has been carefully tested and evaluated during a period when you are not flying.

I am speaking of the "Go" and "No-Go" pills for crew conditioning. As a final note, I'll add a solemn warning NOT TO USE THESE PILLS ON YOUR OWN. It is definitely known that some pilots have considered all green pills to be "Go" and all red ones to be "No-Go." I feel it is absolutely necessary to point out to you that there's at least one green pill on the market that is definitely "No Go!" Let's not be taking pills unless they have been OK'd by your Flight Surgeon! ★

FAA ADVISORIES

Walter J. Wrentmore
FAA Liaison Officer
Directorate of Aerospace Safety

USE OF RADAR FOR THE PROVISION OF AIR TRAFFIC CONTROL SERVICES. Radar has become a valuable and efficient tool in providing air traffic control services. These services are being provided through two basic radar systems, Primary Radar and the Air Traffic Control Radar Beacon System.

Primary Radar is used to provide service to aircraft not equipped with cooperative radar equipment, i.e., radar beacon or transponder. Coverage is limited by power, antennae design and pulse rate of the ground equipment; aircraft returns vary with distance and size or reflective characteristics of the aircraft. These radar displays are nonselective in that all primary radar returns received are displayed, with no means of identification except through correlation of aircraft position or through maneuvers requested by a controller. Complete dependence on recognizable reflective targets from aircraft limits the usable range. This is particularly true in the high altitude environment with the smaller jet aircraft which normally offer poor radar reflective surfaces. On the other hand, it has the advantage of not requiring special equipment aboard the aircraft and can be utilized within its limitations by any pilot having two-way radio.

The Air Traffic Control Radar Beacon System is a secondary surveillance system which may be operated independently of the primary radar, or in conjunction with it. It requires that the aircraft be transponder equipped and provides certain advantages: usable radar range is greater. Radar reflectivity of the aircraft does not affect the return. By use of selected codes or "ident" feature, more positive radar identification can be made and followed.

The FAA has been working with various combinations of primary radar and radar beacon to develop the best combination to suit the circumstances. The controller's radar display may be adjusted to show the primary radar returns only, certain radar beacon code returns only, or a combination. In the positive control area, air traffic control service is normally provided by the radar beacon system alone. The controller by properly assigning radar beacon codes to aircraft under his jurisdiction and then selecting these codes for display, can see only those returns from aircraft under his control. This eliminates confusion resulting from returns from many aircraft not under his control. Aircraft that are not transponder equipped (or where the transponder has malfunctioned) provide no return on the controller's "radar beacon only display," nor do aircraft transmitting beacon codes other than those selected by the controller. In addition, information on weather is not available through this system. However, primary radar will normally be available for use by the controller to supplement his basic radar beacon picture when he needs it to provide weather data, information regarding chaff drops, and as a standby for failure of his radar beacon system.

Outside of the area positive control environment the desirability of providing radar traffic information and other additional services leads to the use of primary radar as the basic tool, supplemented to varying degrees by the radar beacon system. In terminal areas particularly, the use of radar beacon is often minimal since radar handoffs and stronger reflective targets from the closer-in aircraft minimize the requirement for the identification feature and target reinforcement. At the same time, the beacon returns are often excessively large and the number of aircraft in a smaller area result in target clutter often requiring more selective use of radar beacon. Therefore, in the terminal area, pilots are frequently requested to change their beacon to low power or standby, particularly in congested areas. ATC follows published procedures using information obtained from primary and/or radar beacon systems in areas of radar coverage.

In any case, pilots will be advised when the radar system normally used for provision of ATC service is unusable. However, as a rule, they will not be kept advised as to which source of radar data is being used when both systems are operating normally. ★

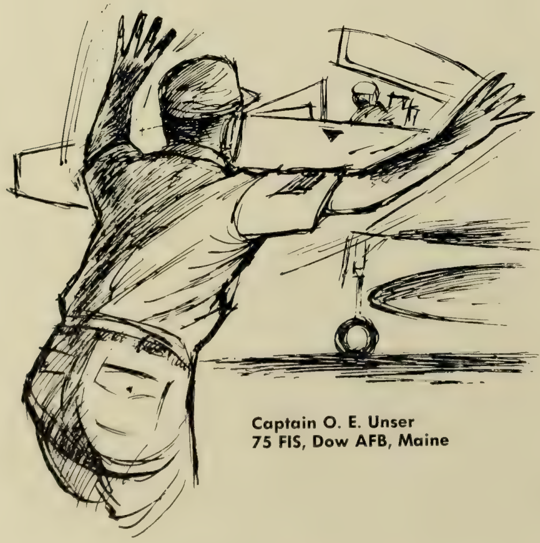
Got your signals straight?

ONE IF BY LAND

The following four tales are unrelated – or are they?

Nr 1. The noise level on the ramp was high. The Sarge couldn't seem to get his message across to me. For a guy who was usually supercalm he sure seemed excited. I read his lips, as he slowly mouthed: ". . . Y.O.U.'R.E. . . O.N. . . . F.I.R.E. . . ! ! !"

Nr 2. I was number four in a formation assigned the job of cleaning out a Viet Cong village. As I came in low, I felt ground fire hit the bird. I completed my run. Lead was saying, "Four's been hit!!" I tried to tell him I was heading out to sea for possible ejection; – no transmitter.



Captain O. E. Unser
75 FIS, Dow AFB, Maine

The headset crackled, "Three, stick with four" — then silence.

The coastline ripped rapidly aft. Three thousand feet—right wing looked bad — better get out!

"Three, this is four, move out, I'm going to eject!" — Nothing.

". . . dammit, move over!" No response.

Speed boards, idle power — three went skidding by. EJECTION!

I saw the right wing fold up; three was clear and okay. I was in a good chute.

Nr 3. The weekend cross-country had been great. No problems with the bird. And that little chick I met last year even remembered! Real swinger — great time.

Now waiting for clearance. Cockpit check almost done. Better check the pitot heat; weatherman says there'll be a 500-foot ceiling on approach. "Hey, Sarge. . . ."

Too noisy, can't seem to make him understand. Oh, well, give him the index-finger-to-the-nose check pitot heat signal. Yep, he's got it; walking toward the front end.

Here comes the clearance—really organized this time—simple, concise. Copied and read back just like in the movies — no sweat!

There's the Sarge — finger on nose and OK sign. Pitot heat is good. Let's crank.

THE NOSE GEAR COLLAPSED! Shut down!

"Sarge, what happened?"

"I don't know, sir, I didn't pull the nose gear pin till you gave me the signal with your finger on your nose."

Nr 4. Engine going, all checks completed, ready to taxi. Pull chocks signal: both fists, thumbs out, rapid movement. Crew chief signals okay. Power up — must be in a hole; more power — *thump!!* It felt like I went over the chocks. Stop, check.

"What happened, chief? I gave you the *pull chocks* signal."

"Well, sir, I was standing a little to the right and I only saw one hand. It looked like you were asking for *electrical power out;* I'd already pulled the power, so I gave you the OK sign. Next thing I knew, you had gone over the chocks!"

Do some of these situations sound familiar? What do they have in common?

From the cockpit of the modern jet fighter it is near-impossible to see the engine(s). At the present time, in your organization how does the man on the ground (usually the crew chief) notify you that "Y.O.U.'R.E. . . . O.N. . . .F.I.R.E! !"

The good book on "Handy Hand-Signals for Aviators and Associates" does not include a signal for this vital communication in its vocabulary. Also missing from the vocabulary is a signal to warn a wingman that you have impending structural failure — that you want to eject. Consider this position. No radio, wingman tight on the right, you can see that the right wing is about to fail, he cannot. How are you going to tell him?

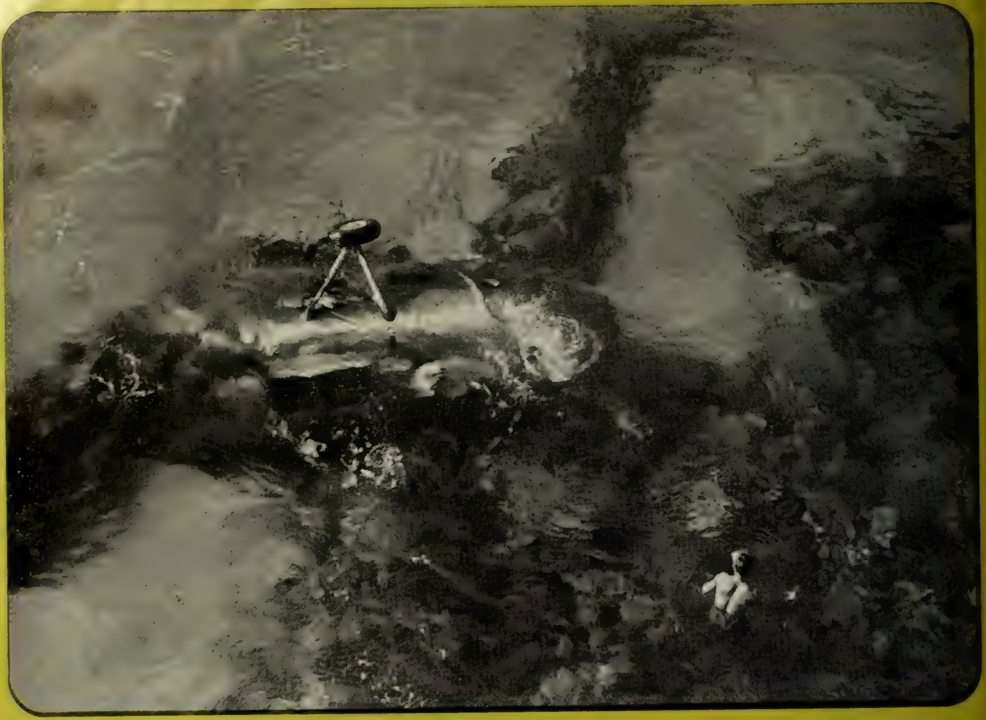
You might consider the idle-speed-boards bit. Is *is* a rather rough way to treat a guy who is only looking after your interests.

The signals mentioned in the above two cases are not included in AFR 60-15. After all, they cannot think of every possible situation. However, in the two cited cases, something must be done. Not only your aircraft is in jeopardy, but also other aircraft in the immediate vicinity. Discuss possible situations with your aircrews. They may offer some pet theories and maybe some "what-I'm-going-to-do's." Pick the best suggestions for your situation. Spread the ideas around; forward them. Then we can all benefit.

Tales Nr 3 and Nr 4 come from a well-known ditty. First verse: unfamiliarity with proper hand signals, use of non-standard signals; improper signaling position or practices. Second verse: same as the first. Etc., etc.

Well, here is your chance to ". . . throw a nickel on the grass . . ." Take an hour to review hand signals in your squadron. If you find a lack of knowledge or a non-standard practice, you have found an accident or incident in the making. It does not take much to correct the situation: a demonstration, a series of photographs (for display in the ground crew lounge and the aircrew briefing room), and a practical test, to be sure the "message" was received.

Another excellent place for your photo series is your checkout folder. When a new man arrives, he immediately jumps on the bandwagon. He will not be the one who, during the investigation following an accident or incident, says: "That is the signal we used at my *last* squadron . . . !" ★



no colonel, it's not a TOY

Capt Donald V. Amodt, USAF

The salmon paid very little attention to the pile of metal that lay in the bottom of the river. Their drive to get up stream to spawn pushed them on.

The Flying Safety Officer from Pine Tree Air Force Base was standing on the bank of the river. He didn't notice the salmon. His attention was focused on the pile of metal at the bottom of the river. A large white star was clearly visible. At times through the rushing water you could detect some letters that looked like U S AIR FORCE.

The FSO didn't have time to think about fish today. He had a fatal aircraft accident to investigate. There were questions that had to be answered, but he would find only part of his answers there in the river.

Let's go back in time two years to a morning when joy was in the air. This started a sequence of events that contributed to this accident.

Lt Boone walked from the hangar out to his helicopter parked in front of Base Operations. He accomplished his preflight with a little more care than usual, because this wasn't just a routine mission. He was flying the Wing Commander out to a remote site for an inspection tour.

He had just completed his preflight when a staff car pulled up beside the helicopter. Col Crockett and one of his deputies got out of the car and boarded the aircraft. After Lt Boone had briefed them on the emergency procedures, he asked Col Crockett if he would like to ride up front in the left seat which is the copilot's seat in a helicopter.

The Colonel had never flown in a helicopter before so he gladly accepted the invitation.

Lt Boone helped the Colonel get strapped in, and then briefed him on the flight procedures as he started the engine and engaged the rotors. To expedite the takeoff, he accomplished the pre-takeoff check as he taxied out to the edge of the ramp. He then called the tower for clearance.

"Pine Tree Tower, Chopper 48. West ramp for a southwest departure."

"Roger, Chopper 48, you are cleared for takeoff; remain clear of the departure zone of runway 23."

"Chopper 48, understand."

Lt Boone brought the aircraft to a hover and slowly transitioned into forward flight.

Col Crockett was impressed by the apparent ease at which the helicopter became airborne and began to fly. He was also seeing the base and the surrounding area as he had never seen it before. He was so taken up with this new experience that he didn't notice the noise and vibration that was annoying his deputy back in the cabin.

The flight was short; only 15 minutes after takeoff they were on the helipad at the site.

As the Colonel climbed out of the cockpit, he asked Lt Boone to pick him up in three hours.

When Col Crockett returned to the helipad, the helicopter was there waiting. On this flight he didn't need an invitation. He climbed into the left seat and strapped in.

After takeoff, Lt Boone asked the Colonel if he would like to take the controls. The Colonel had been waiting for the opportunity and he assumed control of the cyclic and the rudder pedals. He did very well, so well that Lt Boone decided to let him attempt the landing. He called the tower and got clearance for a straight-in running landing on runway 05.

He told the Colonel to hold his airspeed and at about two miles out he reduced the power and started a long, flat, Navy type approach. He was backing up Col Crockett on the controls, and as they came over the end of the runway, he eased back on the cyclic and "greased it on."

The Colonel grinned, "This is just like flying an airplane."

As the Colonel got out in front of Base Operations, he thanked Lt Boone and said he wanted to fly the helicopter again sometime.

He did. In the months that followed, the Colonel occasionally flew the helicopter and developed a certain feel for the shaky beast. He had even managed to struggle through a couple of hovering takeoffs and landings.

Then that fateful day arrived. Col Crockett had requested a helicopter for an 0900 takeoff on Saturday. The mission was to a survival training area 60 miles from the base with four hours ground time at the training area.

Capt Boone volunteered for the flight. Oh yes, Lt Boone had been promoted and had also been made an IP.

He knew this mission was no ordinary inspection tour. This was going to be more of a survey, and

he would get to assist the Colonel. It was going to be a survey to see how well the fish were biting.

When the Colonel arrived at the aircraft Saturday morning, he had two of his deputies with him to assist in the survey. As they boarded the aircraft, he told them that he would ride up front so he could show how well he could fly, as he called it, "his new-found toy."

Col Crockett made the takeoff from the left seat. As he reached 1000 feet, he leveled off and turned on course. After about 30 minutes he picked up the river that flowed through the training area and followed it. He also descended to 300 feet so he could better see the fish in the river.

It was then it happened. The engine quit and in less than ten seconds they had joined the fish.

Seven hours later another helicopter found the wreckage. It looked like a large silver fish. The aircraft was lying on its side under about five feet of water. The crew and passengers were still on board.

The accident investigation will produce some facts about the mishap. A TDR on the engine will reveal failure of the master rod. That was most likely the reason for the autorotation. It can be assumed that the reason for landing in the river was that the aircraft was at too low an altitude at the time of engine failure.

One fact that won't be brought out by the investigation is the control difficulty experienced by the pilot during the autorotation. In the few seconds between engine failure and impact, the pilot had considerable difficulty trying to gain control of the aircraft from the Colonel. He was never successful.

Fortunately, the story as written is not true but the plot is.

Although there is a regulation against it, somewhere in the Air Force today there is a stiff wing pilot getting a "half fast" check out in a helicopter. He may be a lieutenant or a lieutenant general.

The helicopter isn't difficult to fly and that's the big problem. In many respects it flies just like a stiff wing, only it's slower and considerably more maneuverable. Too many stiff wing pilots feel that a helicopter is a simple little machine, good only for chasing jackrabbits and getting into good fishing holes. However, the problems of aerodynamic forces on a helicopter are just as complex as those on a supersonic jet, only different. Without a basic understanding of these differences, it is difficult to attain a proficiency level that is compatible with safety.

Normally these "under the table" checkouts consist mostly of stick time with very little instruction. The pilot learns just enough to control the aircraft. He also learns just enough to be dangerous.

If you become the victim of a fatal aircraft accident, the degree of death is the same whether you were flying a UH-1F or an F-4C. ★

Missilanea

IN THE EVENT missile personnel have to use emergency breathing equipment, how well do these people *really know* the equipment? In an emergency, can they don the equipment as readily and easily as putting on their raincoats? If not, then they are not properly trained.

SAC is currently reviewing all technical orders pertaining to breathing apparatus. One of their objectives is to develop a short, simple checklist to be used under emergency conditions. However, no checklist is a substitute for knowledge when rapid reaction is necessary.

A good parallel is the aircraft pilot who must be able to respond from memory to critical or emergency situations. The pilot's Dash One contains emergency checklists, yet he must memorize certain portions, for in an emergency, *time is critical.* The same should be true of any emergency equipment checklist. It can be a good training aid and supplement to the present technical data. However, in time of a crisis, the user of the equipment will very likely not have time to refer to it.

The old proverb, "He who hesitates is lost," could aptly apply to the individual who is not thoroughly acquainted with his emergency equipment.

Lt Col John R. Cockley
Directorate of Aerospace Safety

TIPSY HOUND-DOG—Two AGM-28 (Hound Dog) forward body adapters were mounted on an Air Log 3010 transport trailer. One adapter was loaded with the forward body of a missile. The empty rear adapter was being removed from the trailer by five personnel. As the empty adapter cleared the trailer rails, the trailer tipped, and the missile body on the forward adapter contacted the floor in a not-so-gentle manner. The pitot static probe was bent, the associated pressure lines were severed, the probe support was sheared from its attaching rivets, and the cannon plug was damaged.

What caused the mishap? Improper positioning of the forward adapter. Tech Order 21-AGM28A-2-2, par 4-21, contains a warning to observe the specified limitations to prevent trailer tip-over and personnel injury. It further requires the limitations be stenciled on trailers used for mounting forward body sections.

All AGM-28 units should insure Air Log 2000 and Air Log 3010 trailers used for forward body section removal have the maximum forward position prominently marked. Air Log 4100B, which is not as critical in positioning requirements, is the preferred trailer for this use.

Captain R. A. Boese
Directorate of Aerospace Safety

WHITE IS BLACK AND YELLOW! There have been several recent occurrences involving the toxic fume indicator showing signs of a leak in the AGM-12 container. This, in itself, could create consternation among the troops, and justly so. None of us are real anxious to go around smelling IRFNA or MAF-1 fumes. Both of these substances are extremely toxic. OOAMA was immediately interested when it was reported that leak indicators in the Bullpup containers showed acid leakage had taken place.

The indicator in the AGM-12 container is white when installed. The left half is susceptible to MAF-1 (fuel); the right half to IRFNA (acid). With an MAF-1 leak, the left half of the indicator will turn black. With an acid leak, the right half of the indicator will turn yellow. Before the container is opened, the indicator should be checked for either MAF-1 or IRFNA leaks. Thus far, 20 container indicators have exhibited acid leaks. These 20 cases involved new aluminum containers in which missiles had not been installed.

OOAMA, the Navy Materiels Laboratory, and the manufacturer of the indicator are all working on this problem. OOAMA has checked some missiles which were in containers having an indicator color change. No acid or fuel leaks, or leak odors, have been found to date. OOAMA will keep us informed on the progress of the solution to this leak indicator problem.

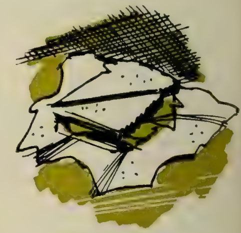
Lt Col H. M. Butler
Directorate of Aerospace Safety

AERO BITS

PRIOR TO TAKEOFF the pilot of an F-100 noticed a low EPR reading. He aborted and returned the aircraft to the ramp for inspection. That was possibly the smartest thing he ever did. When the engine was inspected, a piece of intermediate compressor case approximately 16 inches square adjacent to the dummy bleed valve was missing. Approximately 30 inches of intermediate compressor case cracks were found in the same area and in the area next to the fuel flow transmitter. The engine had flown 626 hours since major overhaul and had no previous history of low EPR.

AFTER FOUR HOURS of flight in a C-124, a passenger asked the flight mechanic for his lunch and was told that the lunches were in the nose compartment. While searching for the lunches, the passenger managed to get hold of the nose entrance hatch emergency release handle. Yep, away went the hatch—fortunately the aircraft was over a desert area.

A flight lunch was involved in another incident, although indirectly. Some sandwich wrappers were drawn through the open pilot's window of a C-119 and went into the left engine. Torque began to fluctuate and RPM surged. The engine was shut down and a single engine emergency landing was made. When the engine was inspected, a sandwich wrapper was found jammed against the left carburetor air intake.



THE PILOT OF AN RF-101 noticed a slight shimmy on the landing roll, then after turning off the runway and jettisoning the drag chute, he saw the gear unsafe light in the handle illuminate and the nose gear safe light go out. Simultaneously the nose gear steering failed. Prudently, he called for gear down locks and a tow. After the down locks were installed the engines were shut down and a cursory inspection of the nose wheel well was made which showed no apparent damage or hydraulic leaks.

During the towing process the tow vehicle had to stop for clearance to cross the runway. As it did so, the nose gear folded aft and the aircraft settled on the strut and tow bar. This resulted in some minor sheet metal damage, and it was found that before the engines were shut down some damage had occurred.

Cause of this incident was faulty maintenance in that the left rear trunion pin (PN 20-45096-3, Fig. 83, Index 28) had been improperly installed. The bolt had not been put through the pin. The aircraft had made six flights since this faulty installation and the pin had gradually worked loose and finally came out completely when the aircraft turned off the runway. During taxi and towing very little force had been exerted toward the pinless trunion, but when the tow vehicle stopped, most of the weight of the aircraft was placed on the trunion. The strut twisted, which broke the lock link assembly and allowed the strut to fold rearward.

PREVENT ICE FORMATION — A pilot reported an increasing exhaust gas temperature which led him to believe that the inlet areas to his engines were icing. Rather than turn on the anti-icing system and take a chance on FOD from large chunks of ice entering the compressor, he elected to let down to a lower altitude. This was effective and his exhaust gas temperature returned to normal in a short time.

During almost any time of the year, icing can be a problem and a definite awareness of possible icing conditions should always be maintained. Staying out of known icing areas is the prime solution, but if it is necessary to pass through such areas, then anti-icing systems should be turned on before ice forms. Anti is prevention, not removal.

Jet Service News
General Electric Company

YOU C-124 TROOPS should beware of an innocent looking local modification of the trash receptacle door on the crew compartment buffet. We're talking about the thin metal ones that open downward and are spring-loaded to the closed position.

A crewmember recently received major injury while placing trash in the receptacle. As he started to withdraw his hand, the spring-loaded door closed on a finger. The natural response was to jerk his hand free and in so doing he cut away the flesh of his middle finger. The Air Force lost the crewmember for 21 days of duty including seven days' hospitalization—not to mention the pain and inconvenience to the individual.

If your birds are equipped with this little finger trap, maybe a chat with the maintenance people is in order.

Lt Col Wallace H. Carter
Directorate of Aerospace Safety

THE RIGHT PLACE AT THE RIGHT TIME! The pilot in the front seat was completing his second ride in the F-4 with an instructor pilot in the rear seat. Approximately 30 minutes after takeoff external wing tanks went dry. Internal wing transfer switch was in the normal position. Fuel readings by the pilot to the instructor were in two figures consisting of tape over counter until the external tanks were transferred, then only one fuel figure was read to the instructor pilot. The instructor assumed that tape and counter were the same since he was unable to view the gage due to the large size of the pilot. After 1 plus 10 of flight, VFR touch and go landings were commenced. Upon completion of the 7th touch and go landing, the throttles were advanced for go-around. Approximately 10 feet in the air, both engines flamed out. Gear and flaps were still extended so a landing was accomplished on the remaining runway. Normal braking was used to stop the aircraft 2000 feet short of the barrier. Tail hook was extended as a precautionary measure.

Investigation revealed that the front seat pilot had left the external fuel transfer switch in the outboard position—as advertised he got no transfer of internal wing fuel into the fuselage tanks. This is one IP who will insist on hearing tape over counter fuel readings whenever he asks for a fuel check. It is recommended that all IPs follow this procedure. The next similar occurrence may not happen at such an opportune location.

Maj Robert F. Brockmann
Directorate of Aerospace Safety

AERO BITS

FOLLOW THROUGH — In golf it's keep your eye on the ball and follow through. When shooting skeet, if you stop your gun when you pull the trigger, odds are that you'll miss. In business following through is often the difference between success and bankruptcy. There's one situation, however, where following through can get you into trouble.

A review of accident files reveals records of some pilots being killed because they wanted to see where their rockets hit the target. They "followed through" to the extent that they couldn't pull up soon enough and crashed into the ground.

Other files indicate aircraft damage caused by the pilot's tracking his missile or rockets when he should be taking evasive action. Our missiles and rockets are the best that money can buy, and they should always perform as expected, but sometimes they don't.

The pilot who is "tracking" his missile when he doesn't have to guide it is begging for trouble. If the missile or rocket malfunctions, he's pretty close to the explosion.

An aircraft was damaged recently, and an excerpt from the report reads as follows: ". . . The launch mode was intended to be a standard 'bomb run' with an escape maneuver immediately following launch. The pilot, however, decided to track the missile and the aircraft sustained minor damage at the inboard leading edge section of a wing flap supposedly from impact with pieces of the motor fin . . ."

This pilot was lucky. He could have caused FOD to the engines, and could have lost the aircraft and his life.

Our scoring systems are the finest allowable by the state of the art. Your hits will be scored, and your near misses will be measured in inches.

Many people in this world have been asked, "In whom do you place your trust?" For my money, one answer to this question by pilots should be, in the scorer.

George W. Williford
OOAMA, Hill AFB, Utah

FALLOUT

continued from inside front cover

scribes the same maneuvering area side as the barb type depiction that calls for a "Left Turn."

The best portrayal would be the one that is the simplest, the easiest to read, and one that is the most familiar to pilots. As entry procedures for holding patterns and procedure turns are almost identical, it seems that they should be portrayed the same.

Capt Dale L. Reynolds
C-130E Stan/Eval Pilot
4442 CCr Tng Wg, Sewart AFB, Tenn

The USAF Instrument Pilot Instructor School is continuing to evaluate pilot reaction to procedure turn depictions in use. This letter is an example of those being received by the IPIS, and typifies outstanding interest and initiative from an Air Force pilot.

To The Editor, IPIS Approach

I very much respect your article "IPIS Approach" published monthly in AEROSPACE SAFETY. As a new pilot I would be very interested in obtaining as many back articles of "IPIS Approach" as possible. If these publications are not easily accessible, I would like to suggest that your school publish annually, in one volume, all the "IPIS Approach" articles from the preceding year. I am sure many pilots, including myself, would be more than willing to pay for any such publication if it were made available. If you find this idea feasible you would be complementing any already valuable service which you provide Air Force pilots.

1st Lt William N. Payne
69 Bomb Sq, Loring AFB, Me.

Copies of all IPIS Approach articles to date are available from the USAF, IPIS, Randolph AFB, Texas 78148.

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 201-220/12

WELL DONE

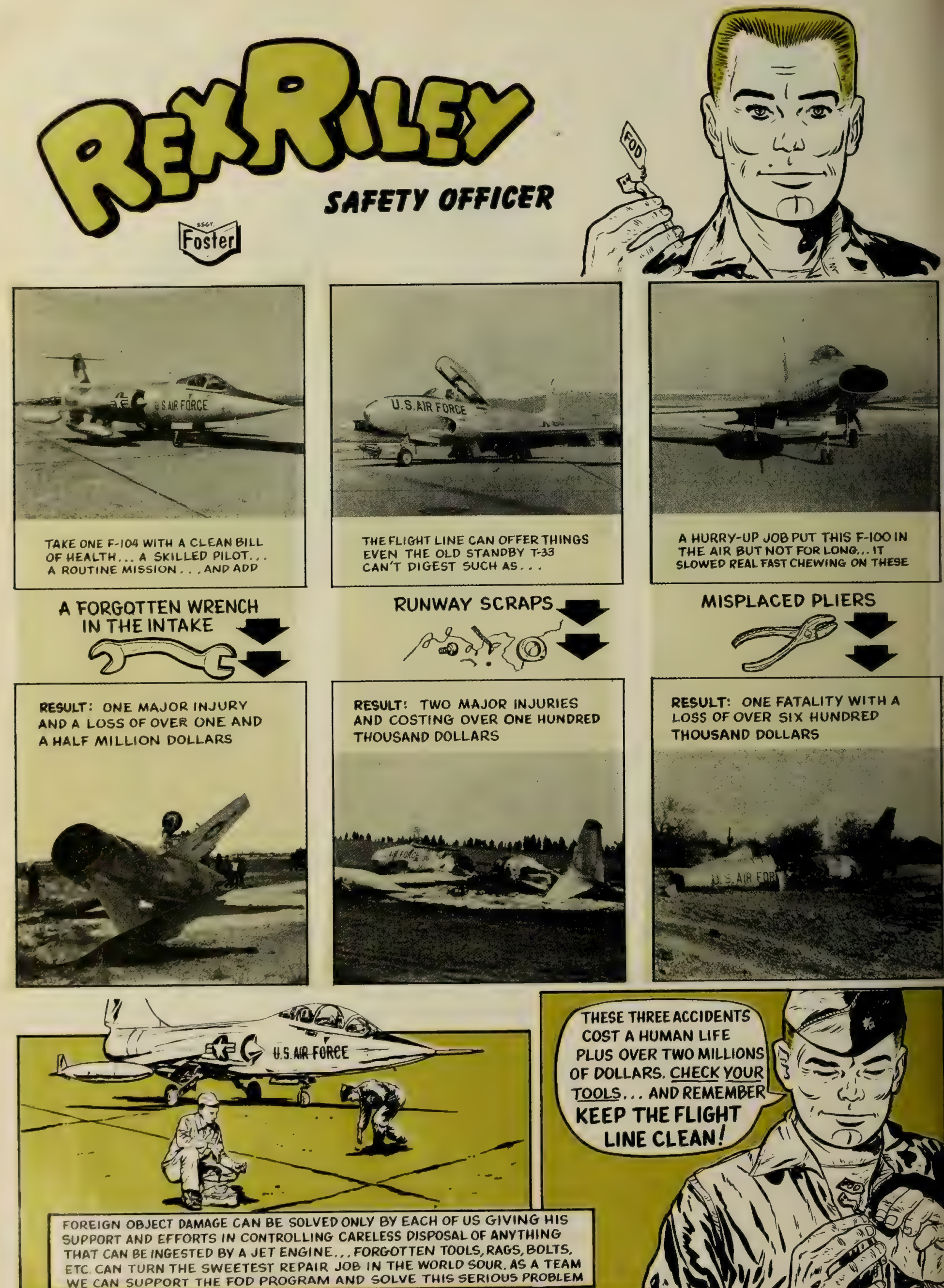
CAPTAIN ARTHUR D. KERR

961 AEW & CON SQ, OTIS AFB, MASS.

Captain Arthur D. Kerr, an instructor pilot, was flying a local VFR transition upgrading flight in an EC-121H. His student, Captain Paul T. West, was in the left seat, and was performing a practice boost-out landing. On final approach, at less than 100 feet above the ground, they heard a loud snap under the flight deck. Simultaneously, the control wheel deflected fully to the right and the aircraft began to rock laterally. Since the aircraft was not properly aligned with the runway for a landing, Captain Kerr took the controls and throttles and executed a go-around. By using rudder and asymmetrical engine power, he was able to maintain lateral control of the aircraft. He climbed to a safe altitude and trouble-shot the systems. The control column was binding, and aileron control could not be established in either the boost-on or boost-off configuration. The yoke stayed fully displaced to the right. The only aileron control that could be established was to roll the wings to the left. Captain Kerr abandoned the use of aileron control and maintained lateral control by using rudder and asymmetrical power. He then lined up a long final approach, still using rudder and asymmetrical throttles to maintain lateral control, and made a safe landing without further incident. After the flight, inspection revealed that an aileron control cable had worn and snapped in the left wing root, causing the aileron to become inoperative, and the aileron control yoke to bind. Captain Kerr's accurate and timely analysis of the emergency and his skill as a pilot averted what might have been a disaster. WELL DONE! ★

REX RILEY

SAFETY OFFICER


SSGT. Foster
FOD
U.S. AIR FORCE
TAKE ONE F-104 WITH A CLEAN BILL OF HEALTH... A SKILLED PILOT... A ROUTINE MISSION... AND ADD
A FORGOTTEN WRENCH IN THE INTAKE
RESULT: ONE MAJOR INJURY AND A LOSS OF OVER ONE AND A HALF MILLION DOLLARS
U.S. AIR FORCE
THE FLIGHT LINE CAN OFFER THINGS EVEN THE OLD STANDBY T-33 CAN'T DIGEST SUCH AS...
RUNWAY SCRAPS
RESULT: TWO MAJOR INJURIES AND COSTING OVER ONE HUNDRED THOUSAND DOLLARS
AIR FORCE
A HURRY-UP JOB PUT THIS F-100 IN THE AIR BUT NOT FOR LONG... IT SLOWED REAL FAST CHEWING ON THESE
MISPLACED PLIERS
RESULT: ONE FATALITY WITH A LOSS OF OVER SIX HUNDRED THOUSAND DOLLARS
U.S. AIR FOR
U.S. AIR FORCE
FOREIGN OBJECT DAMAGE CAN BE SOLVED ONLY BY EACH OF US GIVING HIS SUPPORT AND EFFORTS IN CONTROLLING CARELESS DISPOSAL OF ANYTHING THAT CAN BE INGESTED BY A JET ENGINE... FORGOTTEN TOOLS, RAGS, BOLTS, ETC. CAN TURN THE SWEETEST REPAIR JOB IN THE WORLD SOUR. AS A TEAM WE CAN SUPPORT THE FOD PROGRAM AND SOLVE THIS SERIOUS PROBLEM
THESE THREE ACCIDENTS COST A HUMAN LIFE PLUS OVER TWO MILLIONS OF DOLLARS. CHECK YOUR TOOLS... AND REMEMBER KEEP THE FLIGHT LINE CLEAN!

629.1305
FLYS

AEROSPACE SAFETY

UNITED STATES AIR FORCE

OCTOBER 1966

THE NEW BREED OF BIRD

AEROSPACE
SAFETY

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AFRP 62-1 VOLUME 22 NUMBER 10

Fallout

SAY WHAT YOU MEAN

In your "Personal Equipment Notes" (Jul 66 issue), you note: "The photos at right of batteries taken from survival radios carry a message. Unfortunately, there are some who don't know how to read that message. . . ."

Well, after reading this, one can only wonder why USAF requires that info as vital as the old-age date of batteries must be presented in an esoteric code? There's plenty of other printing—and space available—on most of those batteries. Instead of some Phoenician code, why not just come right out and say in contemporary English (in bold face type, yet): "CAUTION! Change batteries after FEB 1965"—rather than use a cryptic "0265"?

By effectively over-complicating what is actually a very simple matter, it sure looks like someone managed to fumble the ball.

SMSgt Edward M. Parr, AFRes
San Fernando, Calif.

Actually, the date shown is the date of manufacture. Perhaps the message should be "mfg. Feb. 1965."

ICE CRYSTALS AND FLAMEOUTS

I've read with interest your article "Ice Crystals and Flameouts" (Dec 1965) and think there is a rational explanation of why these flameouts occurred, and it is as follows: Most anti-icing systems are designed to cope with supercooled water at temperatures down to say −40°F, which is the lowest temperature at which supercooled water is supposed to exist. Now if one has ice crystals in the atmosphere instead of supercooled water and if these impinge on a heated surface, it is necessary to supply not only the sensible heat required to keep the water from freezing but the latent heat of fusion must also be provided to convert the ice crystals to water. This means that some anti-icing systems which work quite satisfactorily with supercooled water are unable to cope with ice crystals, particularly if the temperature is as low as the −57°C, quoted.

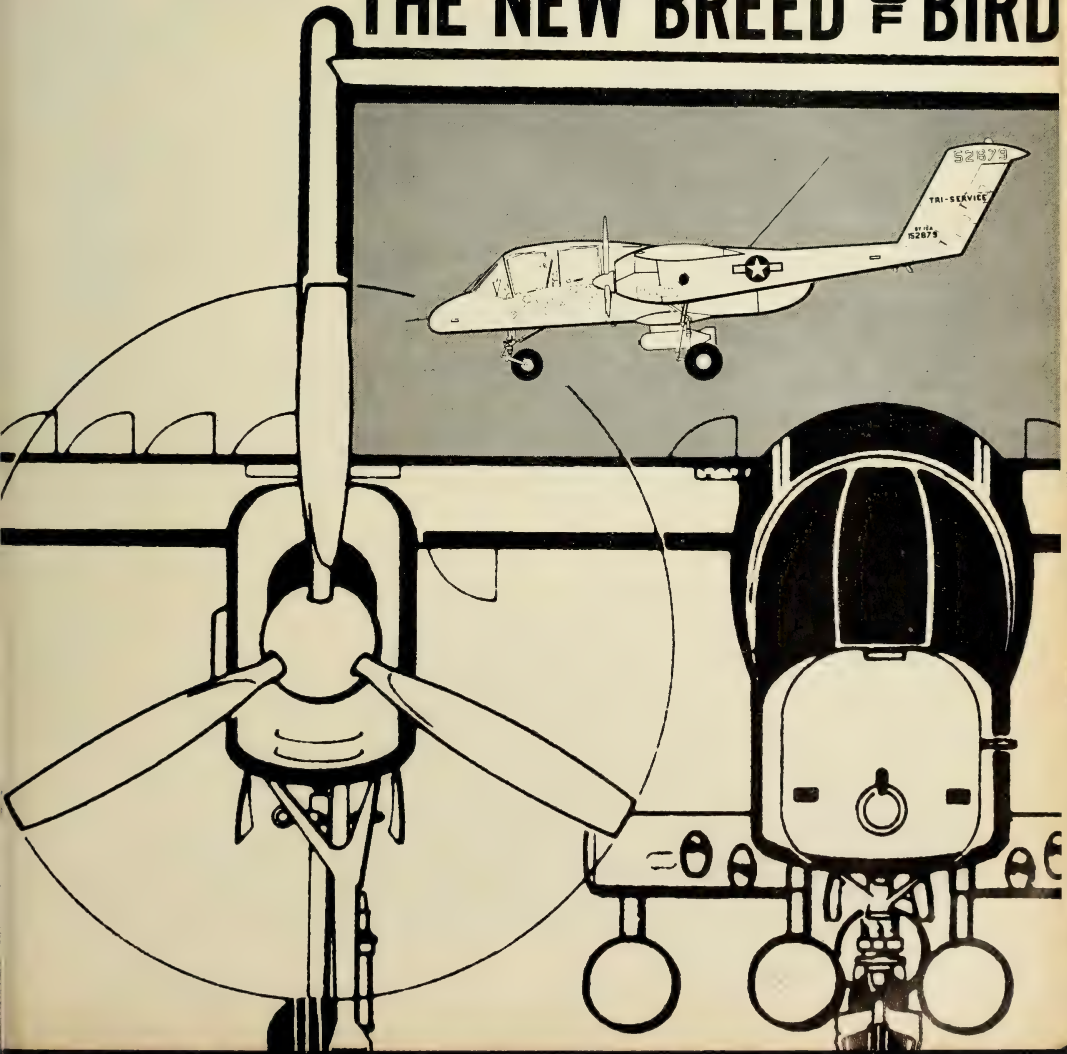
Following this line of reasoning I would assume that what happened to these engines was that the ice crystals contacted the heated inlet guide vanes but were not immediately melted for the reasons noted above and that some quantity of ice collected on the guide vanes. After this ice collected, the heat loss to the atmosphere from the guide vane would be reduced and melting at the ice-guide vane interface would occur with subsequent shedding of the ice. This shed ice could account for the engine flameouts. . . .

E. L. Smith
61 Durocher Street
St. Lambert, P.Q., Canada

Designed for COIN

Operations, the OV-10A Is . . .

THE NEW BREED OF BIRD



Maj Frank J. Tomlinson, Directorate of Aerospace Safety

In the business of thinking up and building new operational systems, particularly aircraft, most thoughts and actions are directed towards developing a system which will fulfill desired operational requirements. This is as it should be, for accomplishing the mission is the only reason for the system's existence. Aerodynamic configuration, propulsion, avionics systems, armament flight controls, and the like are optimized toward mission performance requirements. Systems reliability and airworthiness are additional vital considerations which must be taken into account during the concept formulation and contract definition phases of an operational system life cycle.

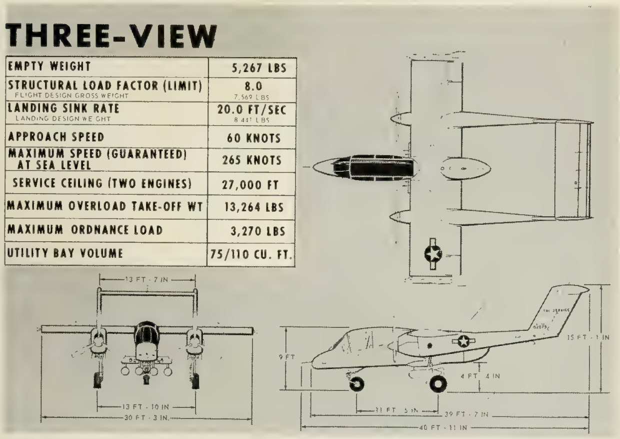
We sometimes lose sight, during the system design and construction process, of the fact that safe operation of the aircraft is of paramount importance. If the bird will perform the mission, but has a tendency to abort, is prone to excessive component failure or is extremely hazardous to operate, then the hope that it will get to the target is negated by the fact that it probably never will.

Some of the newer systems incorporate many safety features which have been developed from analysis of failures. To say that they represent the ultimate in the art of safety engineering application would be rather foolhardy.

However, it is encouraging that some of the more critical problem areas have received special attention during original design formulation and subsequent development.

As an example of some of the safety features incorporated into one of the newest aircraft scheduled for the USAF and USMC inventory, let's take a quick look at the OV-10A. This aircraft is a STOL system designed for COIN and/or FAC operations. Its multi-mission performance capabilities are impressive as evidenced by Figure 1. However, its inherent safety features are more impressive. Here are some of the more significant items of interest from a safety aspect.

- Twin engines which provide for a wide margin of safety during all phases of flight, including combat.
- Simple, uncomplicated systems design, using proven components which enhances overall reliability and maintainability.
- Rugged landing gear optimized for STOL takeoffs and landings from unprepared surfaces.
- Ejection systems for both crewmembers, which is unique for an aircraft in its STOL category.
- Outstanding cockpit visibility for both crewmembers.
- Effective fire detection and extinguishing systems for both engines.
- Excellent maneuverability at low airspeeds which provides the crew with a safety margin during low altitude operations.
- Crew compartment armor and self-sealing fuel tanks for increased survivability during combat operations.
- Engine selection and installation designed to minimize FOD.
- Simple flight control systems incorporating uncomplicated direct mechanical linkage with redundancy features.

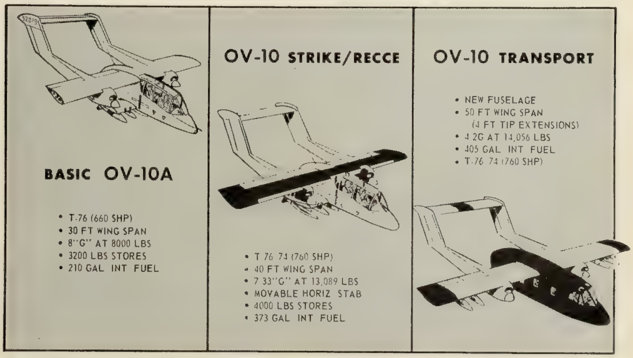


THREE-VIEW

EMPTY WEIGHT	5,267 LBS
STRUCTURAL LOAD FACTOR (LIMIT) FLIGHT DESIGN GROSS WEIGHT	8.0 7,569 LBS
LANDING SINK RATE LANDING DESIGN WEIGHT	20.0 FT/SEC 8,441 LBS
APPROACH SPEED	60 KNOTS
MAXIMUM SPEED (GUARANTEED) AT SEA LEVEL	265 KNOTS
SERVICE CEILING (TWO ENGINES)	27,000 FT
MAXIMUM OVERLOAD TAKE-OFF WT	13,264 LBS
MAXIMUM ORDNANCE LOAD	3,270 LBS
UTILITY BAY VOLUME	75/110 CU. FT.

The items enumerated above serve to illustrate the fact that by the application of sound safety engineering techniques, we can enhance safe operation of a system without restricting its basic mission capability. Preservation of lives and conservation of our combat capability through the prevention of accidents is far too important to be left to chance or happenstance. Safety of operation *can* be designed into a system without degrading mission accomplishment—*it is up to all of us to insure that it is.*

ED. NOTE: A new AF film that tells all about this new concept is now available: SFP 1467 (U). "Aerospace Systems Safety." 20 Min. Color. ★



ACCIDENT REPORT

A FEW DISCREPAN

Two days prior to the accident, the aircraft departed home station on a directed transport mission in support of a rescue operation. Although a qualified pilot was available, an individual who was not qualified in the aircraft was assigned as the copilot. The first takeoff attempt was aborted due to low manifold pressure in number one engine. Nevertheless, motivated by the urgency of the mission, a second takeoff roll was continued with the left engine producing 34" manifold pressure. At destinaiton, the flight mechanic corrected the malfunction by removing a bird's nest from the carburetor intake.

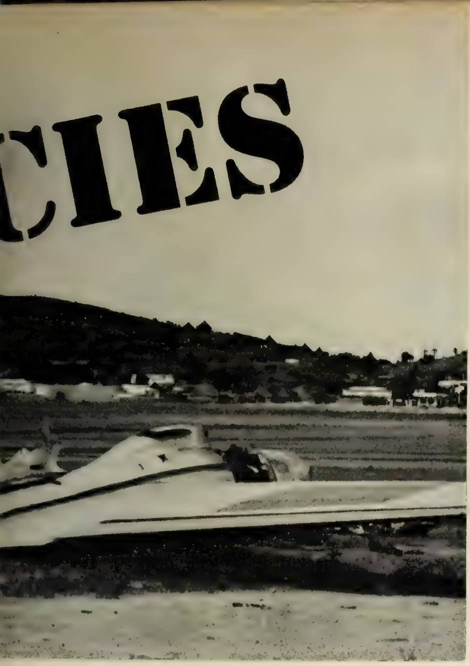
Several flights were made hauling fuel in a remote area. On two sorties, fifteen 55-gallon drums of JP-4 fuel were carried although no tie-down equipment was available. Then, the non-qualified copilot was replaced; however, again with an individual who was not qualified in the aircraft. (During the accident investigation, when the aircraft commander was queried as to what duties the copilot performed, he replied, "Specifically, he filled the seat.")

Prior to the takeoff which resulted in the accident, the pilot roughly computed the weight of his 31 passengers and their field equipment, weapons, ammunition and rations to arrive at a takeoff gross weight. However, a weight and balance Form F was not completed or filed as required, and the pilot did not insure that the aircraft was properly loaded or that the CG was within safe operating limitations. It should also be noted that although no seats or seat belts were installed, supervisory personnel directed the flight. The pilot failed to compute a takeoff and landing data card as required in the pilot's flight handbook; however, he roughly computed a takeoff distance and max allowable payload but did not consider pressure altitude or wind. He guessed at the surface temperature. This information, although available, was not used because his procedure was to have the radio operator file the clearance and get the weather briefing. However, in this instance, as in the two prior sorties, the radio operator failed to get the weather briefing, and the pilot didn't ask for one.

Other discrepancies revealed in the investigation were: no flight orders, the pilot did not have a current flight physical, the flight mechanic was overdue his physiological training, preflight checks were not made as required in the Dash One, crew briefings to include emergency procedures were not made as required and the mandatory items on the "Before Takeoff Checklist" were not reviewed.

Before takeoff, the pilot briefed the flight mechanic to perform the copilot's duties and elected to make a short field takeoff on the 3000-foot dirt strip. He knowingly de-

CIES



DURING TAKEOFF FROM A REMOTE AIRFIELD, A VC-47 CRASHED AND BURNED. FORTUNATELY THE CREW AND PASSENGERS ESCAPED WITH NO FATALITIES AND ONLY A FEW INJURIES.

Lt Col Murray Marks, Directorate of Aerospace Safety

viated from the published Dash One procedures for "Minimum Run Takeoff" because, as he stated to the investigation board, he felt "his procedure" was good. He held the brakes, applied full power, then commenced takeoff roll. After reaching 50 knots, the flight mechanic gave the "go" sign, and the pilot called for one quarter flaps. The flight mechanic extended the flaps to one-quarter, which was attained after 60 knots and almost simultaneously with lift-off at about 70 knots; the pilot maintained the aircraft in the three-point attitude throughout the maneuver. (The Dash One procedure calls for the back pressure on the column to be gradually reduced and then to lower one-quarter flaps at approximately 39 knots, keeping the aircraft in a tail-low attitude.)

Immediately after lift-off, the aircraft attained an extreme nose-high attitude — probably the result of the back pressure on the column to maintain the three-point attitude and the excessive speed at which the flaps were lowered. The pilot exerted full forward elevator pressure without making any trim adjustment. At approximately 20 to 30 feet above the ground, he was able to lower the nose momentarily, but the left wing dropped and the passengers (with no seat belts) and the cargo (not tied down) fell to the left side of the aircraft, aggravating the situation.

The aircraft pivoted on the left wing and the fuselage returned to the ground about 220 degrees from the takeoff direction. The Gooney slid backwards with the main gear, engine cowling, both props and the left engine separating from the aircraft. Although the aircraft caught fire immediately, evacuation of the crew and passengers was accomplished with relatively few injuries and no fatalities.

The primary cause of the accident was pilot factor in that the pilot used improper takeoff technique and procedure and failed to comply with published directives. A contributing cause was supervisory factor in that the mission was directed with a non-qualified copilot, no seats or seat belts available for the passengers or tie-down equipment for cargo, and mission briefings were inadequate with little emphasis placed on the hazards involved. Pilot factor was also assessed as a possible contributing cause in that the pilot failed to complete a weight and balance Form F and to insure that the aircraft was properly loaded within safe operating limitations during takeoff.

Operation from a remote site is not a license to ignore established operating procedures. Dash One procedures and checklists should be rigidly complied with. Deviations, omissions, and the use of unauthorized procedures frequently result in serious consequences. ★

Mark THE Spot

Capt John Kranz, 317 Ftr Intcp Sq (AAC)

Shortly after noon the first word was flashed to the Squadron. A midair collision! A fighter and target aircraft had collided during an intercept mission. Within 10 minutes everyone in the local area had gathered in Operations. The chatter hushed each time a telephone rang and all eyes searched the commander's face as he replaced the receiver. Cautiously, as though saying it might prompt the reverse, he told the group, "GCI has contact with the target aircraft. He is under control and attempting a recovery minus a bunch of wing. The target also said he had heard the interceptor pilot say he was in trouble and getting out. GCI has marked a chaff bundle which they think is his ejection position."

I looked at my watch and figured there were about seven hours of daylight left. Everyone was looking at the weather board and thinking out loud. The area was circled in grease-pencil. The weather was middle cloud cover with surface winds and a temperature of minus forty. The forecast called for increasing cold after sundown and gusty surface winds. It didn't look very encouraging — too windy and too cold. A parachute landing would be rough, with a wild, dragging ride a very real possibility. And if you get by the landing, you face the numbing, incessant cold. It would be rough, all right, and everyone agreed he'd better be found before dark.

When the target pilot called in from the alert strip, everyone got a real boost in morale. The landing was no sweat, he said, but we knew better because the alert pilots who watched the approach said it was the sorriest looking airplane they'd seen this side of a salvage pile. So we all felt pretty proud of the pilot — the way you feel when a fellow pilot does a darn good job.

Night came. There had been signals from the rescue beacon but only intermittently and for too short a duration. At least we were sure he was alive as long as the signals were repeated. But now, with the darkness, the snow began to fall. Visibility in the area dropped so low even the choppers had to hold off. All night the signals were heard intermittently, but as morning came, the signals faded. All day long the area was searched, expanded, and searched again. The second night fell. There were no signals being received anymore and no sightings by any search aircraft. The temperature was holding below minus forty as it had since the first day. We all feared the same thing — it's taking too long. It is very frustrating to wait and wonder and not have any answers. And yet you knew the searchers were doing their best.

Then, on the third day, he was spotted. A chopper arrived and picked him up. Suddenly it was over. It seemed so unreal that after all the waiting, the days of wondering where he was, that he could be spotted, picked up, and be drinking a cup of coffee at the alert site within an hour. But that's what the chopper people tell us all the time anyway, isn't it? Just let them find you or know where you are, and they'll do the rest.

Well, we had a happy ending to this survival episode. The pilot was in excellent shape, just darn tired. He knew what to do in his particular situation and he did everything right. We are convinced he saved his own life for those three days in circumstances which records show many other people have died. He beat the odds. And that's what it's all about, isn't it — beating the odds? Then let's take a new look at aircrew survivability and rescue and see if the odds can't be stacked more in the favor of success.

There are certain factors that enhance the probability of success. Among these are the accuracy of determining the accident/ejection location, the accuracy of determining the ground survival site, and the speed in effecting personnel rescue. The goal, of course, is the successful rescue of the individual(s) involved. Success is acknowledged to be a factor of speed. And speed in rescue is dependent upon accuracy of search. The ratio of successful survival to unsuccessful decreases as search time increases. This indicates that every effort must be made to provide a search capability, on the scene, as soon as possible. The interceptors and target aircraft in this command are not equipped to ADF the rescue beacon. Therefore it is evident in our operation that any consideration of aircrew survivability/rescue must recognize this fact: there is no on-scene, time zero, search capability in the accepted sense of the word. The probability of successful rescue is less than optimum from the start. Until suitable search aircraft reach the general area there is very little positive search action available, and an unlikely chance of visual sighting depending on weather and terrain.

In examining this aircrew survival episode, certain events stand out as significant:

(1) There were no aircraft airborne in the collision area during and immediately following the collision, that had an ADF capability. This is significant in that survival site location could not be determined immediately.

(2) Within 30 minutes after the collision, two interceptors from the alert site flew directly over the survivor. This is significant in that it indicates the response that can be made available through on-scene aircraft, notably interceptors and target aircraft, and the difficulty of visual sighting. It is further significant when survival sites beyond 100 miles of a base are considered.

(3) As the search time continued, the search area was constantly expanded. Although many reports of beacon reception were forwarded, there was no clearly defined, precise position indicated. As the weather turned unfavorable, the decreasing probability of success was evident as the rescue beacon failed. Again, rapid detection by on-scene aircraft would have precluded the difficulties encountered by an extended search.

Our present situation (and probably yours), is considerably less than optimum. Effective utilization of the present, and programmed, rescue beacons is limited to the response time of the support aircraft. Time is the critical element in survival success. A healthy man, with adequate equipment and training, can survive — but not indefinitely. By the end of the second day, the pilot found he was very fatigued. Had there been restricting injuries, precluding mobility, the outcome would have been seriously in doubt.

The odds, then, are improved considerably by on-scene aircraft with an immediate search capability. In our area, ADF equipped interceptors and target aircraft would offer the most flexible and immediate response. In your area the situation could very well be different. But the important point is: is the search and rescue capability optimum? Remember, you bet your life it is. The USAF, you, mother and the kids can accept no less than survivability consistent with the highest state of the art. ★

Recently Lt General R. L. Bohannon, USAF
Surgeon General, made a presentation to the air staf
on the subject of physical conditioning. While
his remarks were made to a rather special audience, th
advice he had to offer applies t
all Air Force personnel who

- *have gained a few inches around the middle*
- *keep puffing on cigarettes despite the advice of a*
  overwhelming number of medical authorities
- *occupy a chair (or a cockpit) for many hours a da*
  without countering the results of thi
  sedentary activit
- *are eager to get to the dinner table bu*
  reluctant to leav

The Surgeon General's remarks add up to good advice fo

I have been thinking that it was about time for me to come over with my little black bag — as your friendly flight surgeon — to remind you of a few principles of preventive maintenance, as they apply to physical fitness and coronary heart disease.

Despite the fact that the American public knows a lot more about medicine than it used to, and can be addressed in sophisticated language, I still intend to speak in common, everyday language, because I believe that only the most straightforward talk is likely to get the message across in the face of the great American tendency to hedge, equivocate, vacillate, dodge the issue, rationalize, find some other way — except the only really right way:

Witness: hundreds of faddish diets — instead of mainly just eating less as a permanent habit.

Witness: the great American affinity for gadgets, and machines, to get around doing work: golf carts, exercycles, relaxacisors, "10 seconds a day physical conditioning" — instead of real physical exertion.

Witness: filter tip cigarettes — instead of *no smoking*.

To begin with: though "executive health" is a phrase we are hearing more and more frequently, and though executives are thought to be subject to certain special health problems because of the unique stresses to which they are exposed, in reality, they are no worse off healthwise than others in their age group, and they should be relieved of the pall of self-concern that has grown up in the popular press.

The executive is a superior person, who usually has fewer difficulties and better health than most people — *if* he follows sensible safeguards and avoids excesses of *all* kinds.

However, that "if" is the item about which I want to talk this morning. "IF" he follows sensible safeguards AND avoids excesses of all kinds, such as, overeating, overdrinking, overworking, excessive smoking, excessive inactivity (another phrase for NO exercise). A recipe for a heart attack: Eat too much, smoke a lot, drink a lot, worry, follow a sedentary occupation.

To speak specifically regarding heart disease, our present experience for active duty Air Force members shows that: On an average day, 195 members will be absent from duty for coronary heart disease; and

- one will die before being admitted (there are two coronary artery disease cases dying every minute in the United States;
- 15 will be admitted;
- one will die after being admitted;
- two will be separated for physical disability.

Findings which have been emphasized as potential cause factors in coronary heart disease are increased serum cholesterol level, increased blood pressure, overweight, reduced lung ventilation, electrocardiographic abnormalities, physical inactivity, high dietary intake of calories of saturated fats, cigarette smoking and heredity.

For prevention, first, I would like to impress upon you the importance of *diet*. We all have a tendency to become less active as the years pass and to eat more than we should, which results in overweight. Excess weight, even in mild degrees, and even at middle age, is directly related to excessive mortality rates. When the problem is recognized, everyone wants a special diet. But fad diets are not the answer; with such diets, people usually regain lost pounds as soon as they begin to feel virtuous about having lost weight, and begin to be "good to themselves" for awhile. So, the main thing is really to just eat less; *i.e.*, change your eating habits for good, not for just a few weeks. It's largely a matter of will power; and I hesitate to believe that anyone of you, having attained his present considerable status, lacks will power. It's more likely to be a case of indecision. If you are overeating, you must decide to eat less for the rest of your life. Any special diet, for special problems like high blood fats, can be obtained from your flight surgeon. The Air Force policy is that the various types of diets are matters between the individual patient and his physician.

Another cardinal rule for good

You'll not harvest me yet, Mister Grim... for I am a Red White and Blue HEALTHY American
USAF
POSTPONING YOUR FUNERAL

health: If you don't smoke, don't start; if you do smoke, stop; if you can't stop, cut down, and don't inhale. Stopping can be done gradually or immediately, depending on the personality and the decision, and the will power again, which I cannot believe you don't have. I'm not going to bore you with a lot of statistics. Just believe me, the statistics so far amassed are overwhelming. And it's not lung cancer that causes the greater number of people to be incapacitated, but chronic cough, bronchitis, low vital capacity of lungs, emphysema, coronary artery disease, cancer of the larynx, esophagus, urinary bladder. Any reasonable person must admit that smokers are playing with fire in more ways than one.

The late Bob Benchley was known as a man who dearly loved martinis and other potent beverages. Once a friend asked him, "Bob, don't you know that stuff is slow poison?" "Yes," replied Benchley, "But I'm in no hurry." The same could be said more truthfully about smoking. If you are physically able to be here today, the chances are that you will not die from smoking tomorrow or even next week. I can practically guarantee, however, that by smoking excessively you are not postponing the date of your funeral by one day, and you are likely to be advancing it by several years.

Now, after proper diet and no smoking, there comes the third main factor in prevention of coronary disease — *proper physical exercise*. A program of physical conditioning is essential to health. Middle-aged men with sedentary living habits have improved their functional capacities by 25 per cent as the result of a ten-week course of daily 30 to 40 minute workouts consisting of the simplest form of exercise: alternatively trotting and walking. The 5BX exercises (except for a few which might cause knee or back injuries in those who are susceptible) are good for you. But we are working on a new regime of physical conditioning at Lackland Hospital, designed to meet the special needs of the Air Force. I personally prefer limbering up exercises, stretchings, pushups, pullups, situps, and jogging and brisk walking alternately for 20-30 minutes daily, or bicycling, as a change from time to time. Physical conditioning exercises not only help to regulate the body chemistry (decreasing cholesterol levels) but also make me feel better; and they help maintain a larger energy reserve for the duties of the day. They also afford the necessary daily mental relaxation all executives need in addition to semi-annual vacation periods.

Let me wrap this up by repeating the three principal factors of preventive maintenance over which you can exert control, if you are determined to do so: proper diet, proper exercise and elimination of smoking.

See you in the gym? ★

AVAST YE SWABS! WE'VE BEEN TORPEDOED!

Maj Guy J. Sherrill, Directorate of Aerospace Safety

These words, or their more salty four-letter equivalents, would have been entirely pardonable on the part of the Admiral who had just settled down in the stern of a U-11 on a bright spring morning. No sooner had this redoubtable gentleman satisfied himself that the brown-shoe Navy had everything ship-shape than he felt an abrupt shudder and noted an Air Force T-33 emerge from immediately beneath the starboard engine.

Happily for all concerned, both aircraft and their crews returned safely to their takeoff base. Inspection of the T-33 revealed a badly mangled vertical stabilizer and wrinkled aft section. The U-11 incurred damage to the right wing, nacelle, and gear doors.

Mid-airs are like the game of horseshoes. Coming close counts. In this case the troops almost scored a ringer. But the circumstances of this near-tragic accident involved neither skill, cunning, nor any great deal of athletic talent — just two airplanes at the same place at the same time! How so? Let's review it briefly.

The U-11 departed on a VFR clearance and was flying a standard instrument departure route in VFR conditions. It was not under radar control or on departure control frequency and leveled off at 4500′ MSL.

Two minutes after the U-11 took off the T-33 departed the same airfield on an IFR flight plan and a standard instrument departure. Shortly after takeoff, the T-33 was advised of traffic at one o'clock, about two miles. This information was acknowledged but neither T-Bird pilot had the traffic in sight, as they stated over the intercom to each other. Clearance was then received to climb to 5000 feet and this was followed by an IFF code change. The pilot in the front cockpit was flying the aircraft and the copilot was handling the radio and navigation equipment. Just prior to the collision the pilot made the IFF code change and his copilot was copying the climb clearance on his clipboard.

Although weather was reported VFR, an undefined haze condition existed. This plus the location of the sun, 120 degrees bearing and 25 degrees elevation, undoubtedly influenced inflight visibility outbound on the 137 degree departure radial.

Air traffic control was in accordance with directives. The traffic information given was in the nature of an advisory only and not a required function of ATC. The acknowledgment by the T-33 did not include a negative or positive sighting remark.

It all sounds pretty familiar, doesn't it? Turn out of traffic. Intercept that radial. "Traffic one o'clock at two." "Rog." (Probably a bug-smasher.) "Squawk, two-one ident." Little sun in the eyes. Visor down. "Climb to and maintain flight level two three zero." What the hell was that??

We really can't condemn these pilots as culpable of neglect or lack of alertness. The circumstances are all too frequently encountered. The direction of flight was in the direction of reduced visibility caused by sun and haze. Both pilots at various times had their heads in the cockpit to comply with ATC instructions. The climb and convergence angle coincided with blocking of vision by the canopy windscreen frame. The T-Bird had a high overtake rate over the light plane. Each of these items led to the accident.

But lest we forget, also familiar are the right-of-way rules and the responsibilities of pilots flying IFR and VFR.

"An aircraft overtaking another aircraft will give way."

"It is the crew's responsibility to maintain their own clearance from other aircraft when in visual flight conditions even though they are operating in accordance with IFR."

So while we cannot condemn we must request, nay, urge, maximum use of the eyeballs at all times, regardless of IFR or VFR, and an unrelenting search, especially until we hear those welcome words, "Previously reported traffic is no longer a factor."

P.S. There are enough clues above to detect a goof on the part of the U-11 which was not a factor in the accident. First troop to report it correctly to REX wins the title of VFR Pilot of the Month and the accompanying recommendation to fly O-1s in SEA. Any takers??? ★

WIND velocity profiles

Reprinted from Boeing Service News

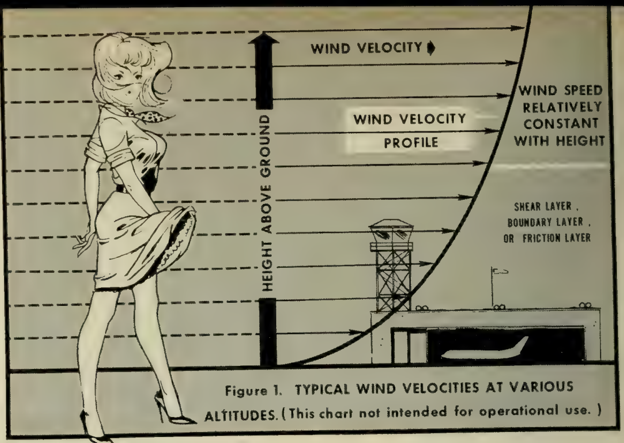

WIND VELOCITY
WIND VELOCITY PROFILE
WIND SPEED RELATIVELY CONSTANT WITH HEIGHT
HEIGHT ABOVE GROUND
SHEAR LAYER, BOUNDARY LAYER, OR FRICTION LAYER

Figure 1. TYPICAL WIND VELOCITIES AT VARIOUS ALTITUDES. (This chart not intended for operational use.)

Since the introduction of emergency war operation downwind takeoffs, the wind velocity profile near the ground is of added significance to pilots. During climbout on an upwind takeoff, the increase in wind velocity with altitude provides a safety factor; but during a downwind takeoff, this increase in wind speed with altitude becomes a tail wind component that must be considered when determining the airplane climbout capability.

The winds aloft move under the influence of forces largely independent of ground conditions. At the surface the wind velocity is always zero with respect to the earth as shown in Figure 1. There is always a shear layer (or boundary or friction layer) at the surface. In this layer the wind velocity changes from zero to the velocity of the prevailing wind aloft. In Figure 1, the wind velocity at various heights is indicated by the horizontal arrows. The heavy line through the end of the arrows is known as the wind velocity profile. The boundary layer is thin with respect to the atmosphere but may be significantly thick with respect to aircraft operation. The height of the shear layer is usually estimated to be from 10 to 1000 feet, depending on prevailing conditions.

The wind profile near the ground depends on the terrain, the temperature lapse rate, the stability of the atmosphere, the time of day, the wind velocity. These factors interact in a complex way making the thickness of the shear layer and the velocity distribution very difficult to predict.

As a rule, wind velocities near the ground are higher during the day than at night, and the ratio of the wind velocity aloft to the wind velocity near the ground is much higher at night than during the day. This is because on a clear day vertical movement of the atmosphere, caused by ground heating by the sun, couples the winds aloft to those near the ground. When there is an overcast during the day (neutral condition), the wind velocity near the ground is somewhere between the velocity on a sunny day and the velocity at night.

Figure 2 illustrates the large variation in the wind velocity profile which could be encountered during climbout. A typical curve is shown for day, night, and neutral conditions. In each case, the reading at the standard anemometer height (14 feet) is divided into the wind velocity at greater heights over the ground to find the velocity ratio. The result is a family of curves of characteristic shape rather than curves of specific data.

The DAY curve shows a significant tailwind increase only during the first 50 to 60 feet of climb. The NEUTRAL curve shows a large change up to a height of perhaps 150 feet. The NIGHT curve shows an appreciable increase in the tailwind component right on up to 300 feet above the ground. All three curves indicate:

- An increase in tailwind can be expected on every downwind climbout.
- The greatest increase in the tailwind velocity occurs in approximately the first 100 feet of climb.
- The airspeed must be monitored very closely during the first several hundred feet of downwind climbout. ★

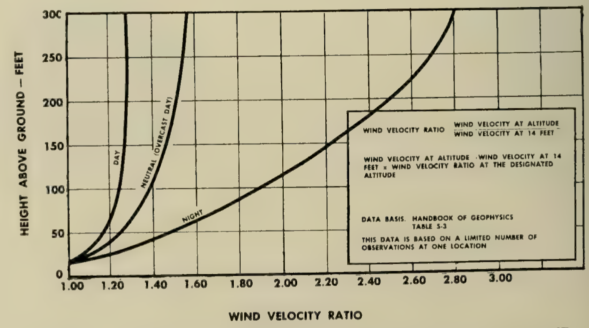
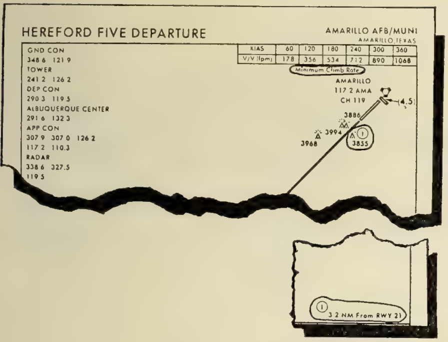


Figure 2. WIND VELOCITY PROFILE CURVES NEAR THE GROUND. (This chart is not intended for operational use.)

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

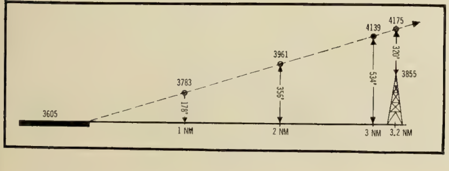


KIAS	60	120	180	240	300	360
V/V (fpm)	178	356	534	712	890	1068

Q Concerning the above SID, what is the significance of the term "minimum climb rate," and how is it used?

A In order to fully understand the significance of minimum climb rates and their use in preflight planning, you should understand how they are established.

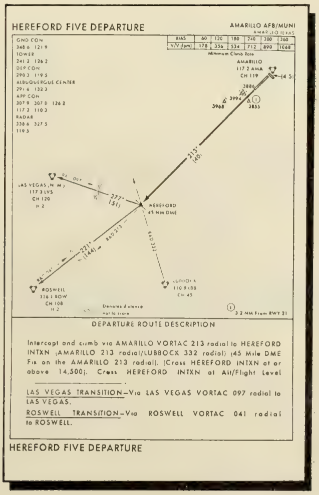
The minimum climb rate is derived from a minimum climb gradient based on the location and height of a controlling obstruction. Determination of the controlling obstruction is explained in SID criteria. The minimum climb gradient provides 100 feet clearance over this obstruction for each mile it is located from the end of the runway. In the above example the controlling obstruction is noted as the 3855-foot obstacle located 3.2 NM from the departure end of the runway. The required obstruction clearance is 3.2 NM x 100 or 320 feet. 320 feet added to 3855 feet MSL totals out to 4175 MSL, or 570 feet above field elevation. Therefore, the minimum climb gradient for the "Hereford Five" SID would look like this:



Now, to determine the vertical velocities required to reach 570 feet above field elevation at 3.2 NM is a fairly simple matter. Dividing 570 feet by 3.2 NM results in a gradient of 178 feet per NM. Therefore, at 60 knots (1 mi/min) the vertical velocity required is 178 FPM. At 120 knots (2 mi/min) it is 356 FPM, etc. (Refer to the minimum climb rate table for the "Hereford Five" SID.)

How can you use this information in your preflight planning? Since the minimum climb gradient begins at the departure end of the runway, any altitude you have as you pass over the end of the runway on takeoff is extra margin in your favor, provided you maintain the minimum vertical velocity. Also, notice how you can compute indicated altitude "check points" as you proceed out the initial climb path. For example, at 2 NM from the departure end of the runway the minimum indicated altitude should be field elevation plus the minimum climb rate specified for 2 mi/min (or 120 KIAS) from the minimum climb rate table (3605+356 =3961 at 2 NM).

Minimum climb rates are depicted to assist you in determining required aircraft performance. Use this information to insure a safe departure. ★



KIAS	60	120	180	240	300	360
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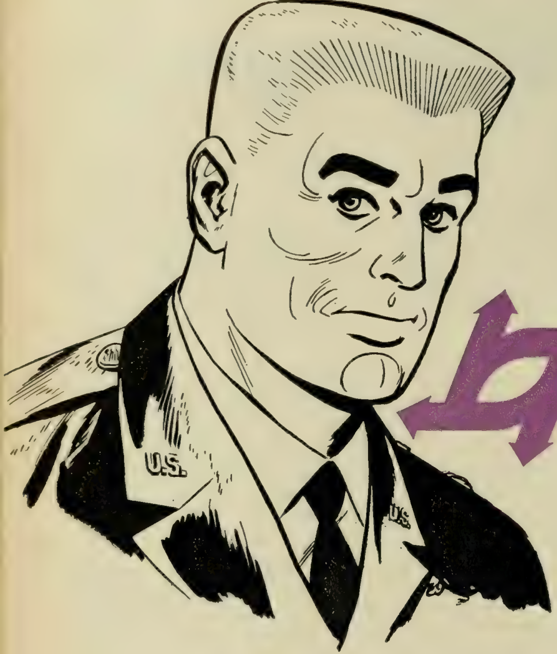
DEPARTURE ROUTE DESCRIPTION

Intercept and climb via AMARILLO VORTAC 213 radial to HEREFORD INTXN (AMARILLO 213 radial/LUBBOCK 332 radial) (45 Mile DME Fix on the AMARILLO 213 radial). (Cross HEREFORD INTXN at or above 14,500). Cross HEREFORD INTXN at Alt/Flight Level ______.

LAS VEGAS TRANSITION—Via LAS VEGAS VORTAC 097 radial to LAS VEGAS.

ROSWELL TRANSITION—Via ROSWELL VORTAC 041 radial to ROSWELL.

HEREFORD FIVE DEPARTURE



Rex Riley CROSS COUNTRY NOTES

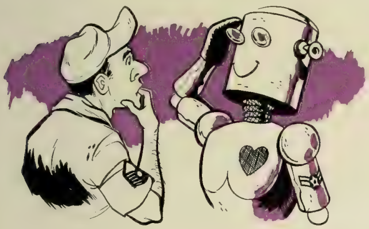
AERO CLUB L-17 was damaged when the pilot misjudged and the aircraft ran off the end into a wire fence and posts. Damage consisted of nicks in the prop and a dent in the leading edge of the right wing. Apparently the pilot, an experienced military pilot with a commercial license, flew a high, fast approach over obstacles into a 2300-foot strip with only half flaps, a perfect setup for a roll off the far end.

EEEEAAAAHHHH!

Aero clubs, generally, have been doing a good job and have improved their safety record tremendously during the past few years. Several recent accidents, however, indicate some laxity in supervision and, possibly, checkout standards. A serious violation of the reg has been the carrying of unauthorized passengers. While supervision may be a factor, this is really a personal matter and violation of this provision of AFR 215-2 indicates lack of personal discipline. Since aero clubs are a privilege, it behooves every member to protect that privilege, and gross violators should be dealt with appropriately.

SUPERVISORY SKILL is being put to a test these days, probably more so than at any other time in Air Force history. The fact that the manning documents balance, as far as bodies are concerned, does not mean that skill levels are always on the sunny side. This means closer supervision is required and that a lot of supervisors by title are going to find out if they really are in fact.

One problem that is always with us is that of the young, partially trained, semi-skilled young airman who is eager to do the job but just hasn't had the time and experience to become a pro. Time was when these youngsters could be pretty closely watched to be sure that their zeal didn't exceed their knowledge and judgment. But that was yesterday. Today a supervisor may find that he has an overabundance of three-level airmen, an acute shortage of seven levels, and some fives that may or may not be sharp at their jobs, depending upon their past experience and the equality of supervision and training they have received. This means a lot of overtime for the boss, the accompanying fatigue and frustration with the possibility that tempers and tolerance may get a bit short. This eventually leads to mistakes, oversights, carelessness and, if acute, to even an I-don't-care attitude. The result is accidents, aircraft out of commission, injuries and deaths.



Unfortunately, we can't reach out and corral a big bunch of sharp supervisors. These are the real pros and it takes time for the development of the peculiar talent and skills that make a first class supervisor. We can't offer these men much relief but we can show them that we appreciate their abilities, their problems and their dedication that keeps them performing at top level. Commanders may be justified in raising hell when the job is not done or not done right, but they'll make a lot of mileage if they are also generous with the pats on the back for the good work that is done and the sacrifices that are made.

STOWAGE. Two recent incidents were caused by improper stowage of equipment in aircraft. Rex may be wrong, but it seems that during the past few months there have been quite a few such incidents in all commands. Those referenced were (1) a survival kit and an extra parachute stowed beside the seat rails. The seat safety pin streamer was lying across the kit and under the parachute. When the seat was lowered, the safety pin was pulled and the firing pin lever caught the corner of the kit and fired the initiator. (2) A canvas nose cover for a B-52 was tied to an exposed expansion body bleed joint. The temperature of the bleed air was high enough to set the cover on fire.

Probably these incidents and others were caused by either ignorance or hurrying to get the job done. Anybody doing anything around an aircraft should know his business, and the job seldom requires so much speed that items can't be stowed properly.

LOW LEVEL ROUTES used by SAC are well defined, published and the times of use are published. Nevertheless, light aircraft frequently intrude, probably because of ignorance of the existence of the route on the part of the light plane pilot. Now, an OHR submitted by a B-52 crew reports that two fighter aircraft were guilty of this same thing. During the terrain avoidance part of the flight, the bomber crew said an F-100 passed overhead within 300 feet, going in the opposite direction. About four minutes later another F-100 passed close to the bomber. It also was going in the opposite direction.

Light aircraft flying through these routes are hazardous, but their speed is such that there is a margin of time for the bomber to alter its flight path to miss the light bird. Jet fighters are a different story. Flight planning should preclude intrusion into low level routes during times when they are in use. ★

Two lives for a fuel tank cap is . . . .

A HIGH PRICE TO PAY

That old jingle that goes, "For want of a nail . . .", is just as true today as when it was first coined. The example in mind does not concern a nail, but it does involve an item just as prosaic — a fuel tank cap. The result, two dead pilots and the loss of an aircraft.

The flight was a VFR night training mission in a T-33 for an IP and another pilot in the rear seat for instrument training. The preflight was conducted by the IP with two maintenance technicians. During the walk-around, the pilot had difficulty in removing the right tip tank cap; one of the maintenance men took over and checked and secured the cap. By the time he had completed this, he noticed the pilot leaving the vicinity of the left tip tank and assumed he had secured the left cap properly. The inspection was completed and the pilot climbed into the front seat of the aircraft.

After takeoff the aircraft proceeded to another base where a couple of GCA low approaches were made. Apparently the flight was normal to that point. The pilot then left the GCA pattern at that base and checked in with departure control for his own base stating that his tips weren't feeding and that he'd like to climb to a higher altitude to see if he could get them to feed.

Departure gave him permission for the higher altitude and the climb was made. The pilot then talked with the operations supervisor at home base, saying he had climbed to a higher altitude, rocked the wings, pulled negative "G," pulled the tip tank circuit breaker and operated the speed brakes to no avail. He had decided that he had a stuck float valve and would have to make a heavyweight landing.

When the ops supervisor asked the pilot if he wanted to get rid of his tips, the reply was that there were no control problems and that he would fly around a while to burn off internal fuel, then make the landing. One ILS approach was made, apparently by the pilot in the back seat. Then the pilot called for the barrier and initiated an ILS approach to a full stop landing.

As the aircraft passed mobile, the approach and flare looked perfectly normal to the mobile control officer, although all he could see were the lights of the aircraft. Over the runway, the pilot asked, "Mobile, are you on?" Just after the affirmative reply, the pilot transmitted, "can't hold . . ." The aircraft then nosed up, rolled left to inverted and crashed inverted 300 feet left of the center line and 3550 feet from the approach end.

Although an emergency had not been declared, crash equipment was standing by and the ensuing fire was under control almost immediately. Unfortunately, the pilots were killed during the crash.

Several items brought out in the accident investigation point to the cause of this accident. The primary cause was pilot factor on the part of the IP because he either failed to recognize a severe asymmetrical tip tank fuel condition, or, recognizing the condition, attempted a landing with the resultant loss of control. This appears to be a reasonable finding, but from another point of view, could it not be said that this is blaming a pilot not for causing an accident, but rather for not preventing one?

Looking back into the history of the aircraft, there were several write-ups in the 781A for tip tank caps. For example: A write-up said, "LH tip tank siphons during flight causing fuel imbalance." The note under corrective action was "Fuel cap was too loose."

Another: "Tip tank caps very hard to remove." Correction: "New caps not broken in."

Another: "Left tip tank fuel cap not seating." Correction: "Tip tank cap screw has to be tightened." And so on.

Obviously the IP, who was a flight examiner, member of the stan/eval board, and considered to be outstanding, did not consider the problem serious enough to abort the flight. Then, when he was asked about dropping his tips in flight, he demurred indicating that he had no control problems. However, examination of the wreckage indicated that full right aileron trim existed.

When the aircraft crashed, the condition of the tip tanks and the fire pattern revealed that the right tip was practically dry but that the left tank contained a considerable amount of fuel.

After this fatal accident, the bad fuel cap problem was solved so we won't belabor that, as such. But this

Investigators examine point of initial impact.

Fire was controlled almost immediately, but pilots were killed when aircraft crashed inverted.

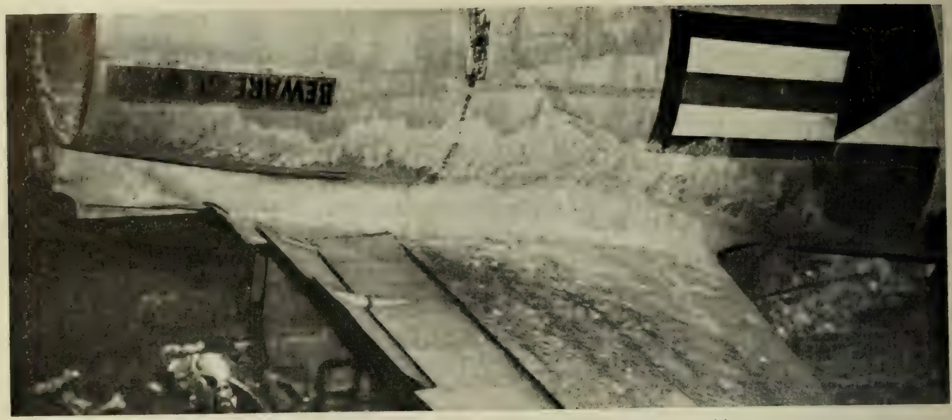


Photo shows horizontal stabilizer with elevator tab in full nose-up position.

accident is typical — if any can be called typical — of accidents that should have never occurred. Here's why:

A small amount of defective equipment got into the inventory—tip tank caps in this case. Although maintenance personnel at the base recognized the problem and worked on the caps, they were not able to get results on all of them. Caps were reordered but had not yet arrived prior to this flight. Units that had UR'd the caps received a reply from the AMA; those who had not submitted UR's were not advised.

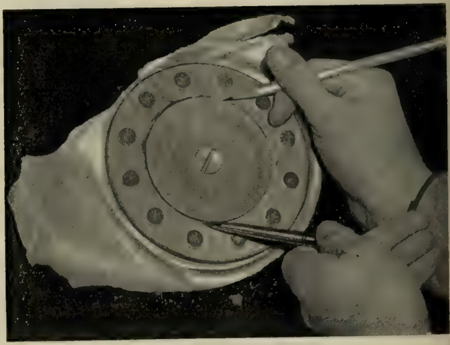
This, of course, does not relieve maintenance from the responsibility of assuring that the equipment is safe and will function correctly.

It is possible that the pilot didn't recognize an asymmetrical condition. He said he had no control problems, but one could speculate as to whether he realized that he had rolled in all the aileron trim he had. (The mobile control officer said the pilot reported checking the ailerons with a flashlight.) This may have kept the aircraft level in flight at higher speeds, but obviously didn't hack it at low speed with gear and flaps during the flare and the apparent attempt to go around.

In summary, what can be said about this accident? First, a minor piece of defective equipment set up a situation that could result in an accident. Then the pilot, for reasons we will never know, decided the aircraft was controllable (despite precautions in the Dash One), failed to drop his tips and attempted a landing. He paid a pretty high price for a bad guess. ★

Damage in left tip tank cap area.

Left tank cap was not fully seated.



OPERATIONAL HAZARD REPORTING

PILOT FACTOR

Lt Col Harold T. Stubbs, Directorate of Aerospace Safety

Our primary mission as Flight Safety Project Officers in the Directorate of Aerospace Safety is Accident Prevention. In our pursuit of the elusive zero accident rate, we look for trends which could develop into accidents if not properly checked. Materiel failures, procedural deficiencies, and after-the-fact hazards, which have resulted in accidents, are fairly easy to remedy through existing reports. A trend in human error called "pilot factor," unfortunately, is not easy to detect in advance of an accident.

We pilots, being human, do not like to point out or broadcast our mistakes and deficiencies. The fear of creating a bad impression on the boss sometimes overshadows the desire to help others from making the same mistake even though a remote possibility exists that an accident could result. After all, we know we sometimes make mistakes, but why point this out to the boss when ER's mean so much? That landing the other night with touchdown just short of the runway didn't damage anything so why tell anyone? It would only create trouble and paperwork—besides, "I've only done it twice before and I think I know what I've been doing wrong now."

As can be readily seen in this exaggerated (we hope) case, a trend has developed that requires immediate attention and correction. It is possible, of course, to correct this deficiency within the unit, but other organizations may need the information to correct a like deficiency which they don't know exists. The Operational Hazard Report (OHR) provides a vehicle for reporting human error incidents and still permits you to remain anonymous. It is true, in some cases, that your unit flight safety officer could pinpoint the individual by checking times, who flew in that environment, etc., if he wanted to do so. But remember, he doesn't want to destroy the value of the OHR.

The point is that we are not getting this type of information at present, and the job of detecting trends in this area is most difficult without it. The desired end result of our effort in this area is to further protect the combat potential of the USAF by saving lives and equipment. Unless you, as a pilot or crewmember, conscientiously use the OHR, our efforts are stymied and all of us are losers. ★

SMSgt Edward M. Parr, AFRes, San Fernando, Calif.

A pint-sized object that has become omni-present on the American scene is the aerosol dispensing container, also known as the "aerosol bomb." Just to see what kind of a BANG we get out of it, let's explore some of the more intriguing fire/safety features of these devices, which are now used for conveniently dispensing everything — literally — from foot powder to suds (soap-type suds, that is . . .)

THEIR CONTENTS

This is probably where one would expect the most obvious of the hazards to be found. Anyone (?) at all would be leery of such normally-risky materials as pressurized car engine starter, oil-base paints, or hibachi primer — after all, they're items that should be kept clear of burning matches and human mouths even when the stuff is found in its more familiar, unpressurized, liquid state. We would usually expect such wares to not lose any of their hazardous properties just because they come to us in attractively wrapped spray containers.

But, one may ask of the fire hazards of something like an aerosol of household bug-killer, "Isn't it just as safe as kerosene?" It's common knowledge that such sprays are mostly kerosene-base, and *everyone* knows that kerosene is much safer than, say, gasoline. So what's so dangerous about it, except maybe to mosquitoes?

True, kerosene may be safer than gasoline, until the kerosene is heated up to about 110°F, *or until kerosene is dispensed into the air in spray-droplet form.* Then, our old "safety solvent," kerosene, can become every bit as dangerous as gasoline! Maybe even more so, because most people seem to generally regard kerosene as always being safer.

Incidentally, that earlier point about what happens when kerosene-type solvents are heated above something in the neighborhood of 110°F explains why a number of Bar-B-Q'ers have been suddenly burned when they've tried priming their reluctant hibachi or picnic fire with the stuff, or with one of its close petroleum relatives. Under those conditions, they might just as well have tossed a ration of high octane onto the coals. Simply put, the moral here is not just DON'T, but rather NEVER!

If you're thinking that the hair spray which milady uses to set her burnished locks in place is a commodity apart from all of this, guess again and read the fine print which appears — hopefully — on the backside of most of these cannisters. Speaking of milady, what's she been using to pull the periodic, first-echelon maintenance on the interior of the family cook-oven? If it's something squooshed out of an aerosol "bomb" — and if the oven is the gas type, complete with pilot light — she'd best either go back to grandma's way of elbow-grease liberally mixed with water and soapsuds, or make darn sure that that pilot light is long gone and the oven stony cold before the aerosol is squirted. It might also be well to note here, in passing, that if any household chemical used for cleaning isn't cutting the mustard — or grease — quite as effortlessly as Madison Avenue ballyhooed it, under no circumstances should the little lady try to soup things up by stirring in some other kind of chemical to boot.

Household chemicals, used singly, are generally fairly uncomplicated materials. Two or more, mixed together, however, may produce completely unexpected and even possibly fatal reactions. The classic example of this was the conscientious housewife who was locked in battle with the stubborn water ring in the family commode. Since the nasty ring stoutly resisted one type of bowl cleaner, she stirred in a portion of a second chemical — with the first still in the water. The two different chemicals, mixed together, generated a quantity of a deadly gas, felling her.

In short, even the ancient Romans had a slogan for it: *Let the buyer beware!*

THE PUSH-OUTER

'Tis easy to see that anything which squirts when its button is punched must have something inside to provide the push. In aerosol dispensers, this is supplied by one kind of gas or another, generally referred to as the propellant. Such good stuff as butane or propane may be used. Since this same gas is often employed to make fork lift trucks go, or to provide the heat in remote-location heaters, its less desirable properties become readily apparent. In a word, it can explode; even if the liquid contents of the "bomb" might be something like a seemingly safe water-base substance.

The noncombustible gas Freon is sometimes used for a propellant, too. While this is certainly a safer arrangement than, say, butane, the true safety of these dispensers depends upon much more than just any single factor such as the nature of the propellant.

LIKE A BOILER WITHOUT A SAFETY VALVE . . .

None of us would relish having such a water heater about the house, but under the wrong circumstances an aerosol cannister can behave in just this way, regardless of the type of propellant and/or liquid which it contains. Here we have a sealed tin can under varying degrees of pressure, but no safety valve to go Pop! if the inside push starts to unexpectedly build up.

There are quite a few stories circulating around concerning what all of this can eventually lead up to. A rather choice yarn is the one about the fellow who, always prepared, started out across the Great American Desert on a hot summer day with a can of pressurized spare tire-inflater in the trunk of his dark blue auto. Toward the end of the afternoon, he heard a muffled Pow! in his aft quarters and stopped to see what had boomed. Raising the lid, he found a sizable dent in one side of the trunk. Seems that one end of the "bomb" had blown out due to the excessive, heat-caused pressure build-up, and the cannister had taken off like a projectile. He got a fringe benefit out of it all, though: The interior of the trunk was very nicely sealed against any future water leaks.

PRECAUTIONS

Like any other hazardous household item — chemicals, medicines (yes, even aspirin) — it almost goes without saying that something having the potential of these cannisters needs to be kept in a sturdy lock-up, well away from the curiosity of small children. A squirt of hairspray — no matter how accidentally—into sister's open eye is no joking matter.

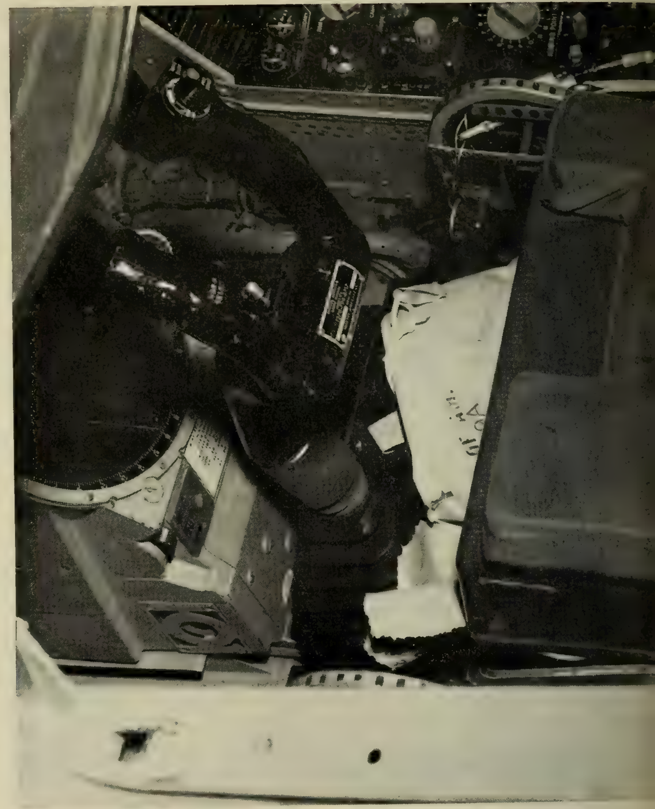
Because of their sealed pressure characteristics, even so-called "empty" cannisters can be expected to explode violently if heated. So, don't toss them into incinerators, fireplaces, picnic fires, or piles of raked and burning leaves. Along this line, a recent fire report refers to an empty aerosol "bomb" which was thrown into an incinerator. When the cannister exploded, the basement door to the furnace was blown off, a first-floor chimney door was blown open, and material in the adjacent basement room ignited. Result: A fire doing $35,000 worth of damage.

If you are a warehouse or supply troop, make certain that none of these devices are being stored near heating pipes, in the direct rays of the sun, or in other unusually warm places. Further, keep stacked cases of aerosols piled low, to lessen the possibility of their toppling. If storage is in a warehouse equipped for forklift truck operations, cases of these items are best stored in a location away from main aisles of forklift traffic. Should the cases bear the Interstate Commerce Commission's red, diamond-shaped shipping label (seldom if ever found on individual cans, only case exteriors), this means that the contents are a flammable liquid and should be handled with the same care and observance to pertinent regs that would be called for by similar quantities of such materials as alcohol and gasoline.

All in all, these devices are neither 10 feet tall nor do they walk with seven-league strides. Handle them with the thought and respect due them for what they are — extra hazardous items — and the omnipresent aerosol "bomb" can be every bit as compatible with you and your continued well-being as any other labor-saving device found about the modern home, shop, office, or stockroom.

But, 'tis always truly spoken: Let the buyer beware! ★

The life raft was designed to be your friend in need; but inadvertent inflation can make it your deadly enemy. There's no room in a tight cockpit for a . . .



RAFT ON THE LOOSE

Maj George C. Braue, Life Science Division

Within one week there were two incidents in which life rafts inflated in cockpits during flight. Both incidents are briefed here to furnish you, the users (aircrew members) and those of you who are responsible for maintenance of survival kits and rafts, the consequences of a RAFT ON THE LOOSE. Read first, be thankful it wasn't you, and then let's go over some lessons learned.

F-5C. At approximately a 4½ G, 450K pullout passing through level flight, the pilot felt a thump and the survival kit pushed him up a few inches. The aircraft was then between 2000-3000 feet, slightly nose high. The life raft forced itself out the left side of the survival kit causing the pilot's left leg to come up to the instrument panel. It then took up the space between the stick and the left console forcing the stick to the right. This caused approximately 6 to 7 consecutive rolls to the right. The pilot was passing through broken clouds between 1500 and 4000 feet and was unable to locate the altimeter or visual references on the ground. Ejection was attempted but the right handle would not raise due to the force of the life raft on the left handle. The aircraft had slowed considerably and the pilot saw the ground and 4000 feet on the altimeter. He took his survival knife from his right "G" suit pocket, punctured the raft, then stowed the deflated raft under his left leg and down under the seat, and returned to his flight position. The pilot estimated this entire incident took place in a space of between five and ten seconds.

The probable cause of this incident was that the over-center mechanism of the valve on the dinghy inflate bottle had "tripped" to the inflate position. The handle and cable for normal operation were in place and had not caused the valve to trip. There is no capability for "G" loading alone to trip a properly positioned valve; therefore, the suspected cause factor is that the valve was partially "uncocked" either from installation or from something inside the kit falling against it after installation.

A one-time inspection of all other F-5 seat kits was accomplished with no discrepancies noted. Also, a "dinghy" knife has been installed on the instrument panel visor to facilitate puncturing of inadvertently inflated dinghys.

Give you the sweats, friend? Then read this next one for the pièce de résistance and see why we are mighty concerned.

F-106. Approximately three minutes after takeoff, after executing a climbing right turn at 450 knots, with a pitch attitude of approximately 20 degrees nose up, the pilot felt a sharp explosion. He was immediately forced against the top of the canopy and the aircraft pitched forward into an approximately 20-degree nose low attitude. The pilot was unable to reach the stick, and immediately commenced the ejection sequence. As he reached for the handle, there was another explosion. He then settled back into the aircraft seat, alighting canted slightly to the right. He was able to control the aircraft and landed uneventfully. The pilot realized only after he had commenced the ejection sequence that his life raft had inflated and subsequently burst.

During analysis of the system, thumb screw, P/N 900520-1, was found to be screwed completely into the bar that holds it. This prevented the ball and roller on the CO_2 valve safety unit assembly, P/N F900476-1, from seating. In this condition the CO_2 bottle could very easily have been fired by minor vibration. The bottle slides back and forth slightly in its mount, and this sliding is normal; however, under the conditions described above, it would be enough to fire the bottle. The set screw holding the thumb screw was loose, and the survival kit container was packed in a rather disorderly manner which made packing of the raft uneven and placed stress on the fitting between the raft and the bottle, which may have helped to unseat the inflation valve.

All rafts should be inspected to ensure proper thumb screw clearance and this incident should be given the widest dissemination possible in order to prevent recurrence.

Instead of being available to save a life in an emergency, the raft became an instrument of an emergency, nearly causing the loss of life and a loss of an aircraft. Why? Apparently due to faulty installation of the CO_2 cylinder and its actuating mechanism.

Inadvertent life raft actuation appears to run in cycles. The personnel responsible for the maintenance and inspection of survival kits and the installation of life rafts must return to strict adherence to T.O. procedures and instructions.

Supervisors must provide closer surveillance of work performance. Personal equipment technicians' functions are just as crucial as those of specialists involved in the maintenance of the aircraft itself. Witness these two incidents: two lives, two aircraft, redeemed only by the grace of good fortune. A good question to ask oneself: Could this happen in my shop? Better yet, a more personal question: Could this happen to a kit I packed?

To the aircrew there should be many lessons derived from these two incidents. First of all, it can happen and not only that, it can happen at any time. Unfortunately, we haven't been able to "Murphy" proof the raft inflation system. Seems like Murphy slips in to prevent actuation when we need it, and, just as bad, causes actuation when we least need it. As noted in the F-106 incident, it takes a while to recognize the problem. We hope that the publication of these incidents may alert you to what occurs in inadvertent raft inflation.

Secondly, we note that the raft may jam or interfere with the controls; however, we can't predict what reaction will occur to raft pressure on the controls. In one, a rolling action; the other, a dive ensued.

Thirdly, ejection may be impossible due to inability to reach the ejection controls. This is the first case where we have had described the difficulties of the F-5 pilot in that the raft held the handles down. A little imagination can be used to foresee other problems, such as raft covering the D-ring or the seat handle.

Finally, we can again see the need for some available means of puncturing the raft if this should occur. We can remember an exercise in "Pig Sticker" or Raft Puncture Device positioning undertaken back in the F-86 days. Pig stickers were taped to the stick until a volunteer fired a raft in the cockpit on the ground for demonstration purposes. Before he turned purple, it was noted he could no more reach the stick than he could hold a martini, for he was crammed up into the canopy under the instrument panel shield. Some sort of device should be placed either on the man or high in the aircraft to be readily reached when the pilot is forced up into the canopy. The F-5 pilot was unique in that he could reach his "G" suit pocket and knife. Incidentally, we know of cases where a pencil was used to do the job.

A bright spot may be on the horizon as the Life Support SPO brings out a newly designed inflation assembly for life rafts called the FLU-2A/P. This new light weight bottle has a different actuation mechanism that can be activated from any direction of pull, thus eliminating some of our failures to inflate. It appears to be less complicated and less vulnerable to activation by shifting in the kit. Heard this story before? Hope springs eternal. ★

NEW FACES

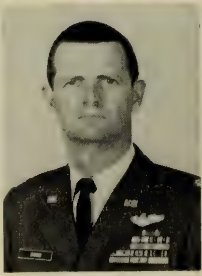
New assignments in the Directorate of Aerospace Safety include Col James G. Fussell, who has taken over as Chief of the Flight Safety Division, and Col James P. Hagerstrom, Chief of Fighter Branch.

There are also three new project officers whose pictures, assignments, addresses and phone numbers are supplied so that they may be reached directly by those of you who may need their assistance.

Tactical Section

AFIAS-F-2B
Ext. 6778, 3886, 2277

Maj Michael J. Filliman
F-104



Maj Robert M. Bond
F-105, F-84

Transport Section

AFIAS-F-1B
Ext. 6284, 6258

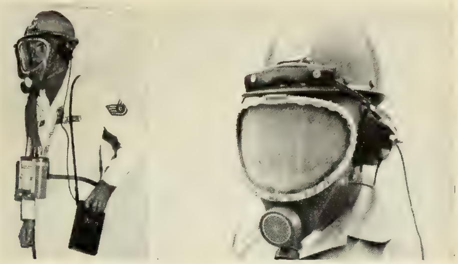
Lt Col Murray Marks
CV-2, CV-7, C-47, C-54
C-121, C-46

Missilanea

DON'T LOOK UP! — Airman Smith was not enthusiastic about assisting Sgt Jones in running pressure checks at the base of the missile gantry. It was a hot sunny day and he was perspiring under his hard hat. He probably wished he were fishing at the lake instead of working at the space launch complex. He may have been thinking about a big bass on the end of his line when he heard someone above him in the gantry, shout "Look out below!" Airman Smith looked up to see who shouted, and WHAMMO!! the lights went out. Later, when he awoke in the hospital, Airman Smith was informed that when he looked up to see who had shouted, a screwdriver (dropped from above) entered his mouth and pierced his tongue and lower jaw. Fortunately it missed his eyes and other more vulnerable areas.

You may say, "That could never happen to me because I don't work in a gantry and I always wear my hard hat." You could be dead wrong. A hard hat does not protect the face of a worker when he looks up. If you are down in a missile silo, under the edge of a building, or near a telephone pole, you are in a similar position. The point is, when you work where other people are above you, try to stay under protection. If this is impossible, pause a moment before looking up when you hear a shout. It may save you from injury — or even save your life.

Maj D. E. Cook
Directorate of Aerospace Safety



TIN EAR. The contract for the purchase of head sets for use with Titan II breathing equipment has been finalized. The delivery date is specified as 31 October 1966. TCTO 21M-LGM25C-699, to accomplish the modification, will be distributed concurrently with hardware delivery.

This very significant advance in safety/emergency equipment is the result of a great deal of effort and team work expended by personnel of the Directorate of Materiel and the Safety Division, SAC; Titan Tech Services, OOAMA; Electronics Branch of Service Engineering Division, SMAMA; and the Inventory Management Division, WRAMA.

Special mention is made, however, of the contributions made by 1st Strategic Air Division, Vandenberg AFB. Major Herman F. Profit, Project Test Officer, with the assistance of highly qualified communications, operations, safety, and contractor personnel, proved the feasibility and practicality of this modification.

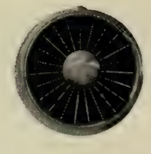
Lt Col Kearn H. Hinchman
Directorate of Aerospace Safety

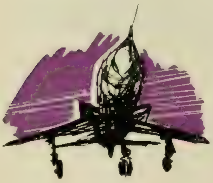
WANTED: TALLER CREW CHIEFS. The night was dark and cloudy. Suddenly, the quiet was shattered and another alert force exercise was underway. The B-52 crew chief hurried to get his aircraft ready for the operation. Quickly he moved to his AGM-28 missiles. While removing the pitot probe covers, he pulled downward, bending not one but each of the probes on both missiles. Scratch two Hound Dogs for the evening exercise!

Personnel Error: The pitot probe is approximately eight feet above ground and must be removed by pulling it almost straight forward—not down.

Since all of our crew chiefs aren't at least six feet tall, a new pitot cover is being designed. This will allow our short crew chiefs easy and rapid probe cover removal by pulling in any direction. ★

Maj E. D. Jenkins
Directorate of Aerospace Safety

AER  BITS



F-105 FOD — The aircraft was impounded for investigation of rapid stick movements and freezing of the stick with the stab aug engaged. A quarter inch drill bit and spacer were found in the aft section of the aft stick well. Scratch marks in the well and paint on the drill bit indicated that the bit lodged between the stick linkage and the well floor in such a way that stick freezing could occur.

A-1E NIGHT FORCED LANDING—The student pilot was on a night local area training flight when engine power suddenly advanced to 56 in. MAP and stabilized. Throttle movement had no effect on engine power. Knowing that he could not land the aircraft at this high power setting, the pilot climbed to altitude over the home field and shut down the engine. He then set up a forced landing pattern and successfully landed the aircraft without further incident. Investigation revealed that the MAP regulator diaphragm had failed.

This pilot knew his aircraft systems, basic aircraft performance and emergency procedures from A to Z. His skill and courage saved a sorely needed combat aircraft and he deserves a pat on the back for doing a job.

Maj. Frank J. Tomlinson
Directorate of Aerospace Safety

AFTER A PRACTICE INTERCEPT mission was completed, the pilot of an F-89 cancelled IFR to recover VFR. On the way back to the base he made two passes over his parents' home to impress his brother who had just returned from Vietnam. As he pulled up after the second pass, the right wing failed and the aircraft disintegrated in the air. The pilot ejected okay, but the RO was fatally injured by the resulting explosion which hurled him from the aircraft.

The final report is not complete but it appears that the wing was over-stressed. You old '89 drivers will remember the problems the bird had back in the early '50s. The wing was beefed-up but critical overload restrictions were put on, especially at low altitude. Age certainly hasn't improved the situation, as it hasn't for any of our other aircraft that are still flying well beyond their life expectancy.

We might make an analogy of these aircraft to some of our 40-ish year old officers. We are okay as long as we remember we are 40-ish, but when we forget and try to act like 21-year-olds, we start having materiel failures. These old aircraft will function okay too if we treat them with the respect their age dictates.

Disregarding directives and restrictions is certainly not respect. It also puts the rest of the crew in a difficult situation. In this case a deadly one.

Maj. Don R. O'Connell,
Directorate of Aerospace Safety

THE ACCOMPANYING PHOTO tells a story by itself, but there are a few details of this fiasco that the picture doesn't explain. To be brief, the C-123 whose mangled tail appears in the photo was towed into a hangar through a door 47 feet high. The trouble occurred when another tow crew attempted to move the aircraft out through a 30-foot door. The C-123 stabilizer is 34½ feet tall.

Actually this wasn't a towing crew; rather, it was a group of men acting as a tow crew. A couple of the men were members of the C-123 crew; they thought someone else was responsible for the movement. The airman driving the Coleman was qualified as a driver but not as a towing operations supervisor, so he thought someone else was in charge. There were some other airmen and a civilian in the act, all thinking that one of the others was the boss.

To complicate matters, a sign by the hangar door operating switches gave the clearance and stated that certain aircraft could not be accommodated by the door. The C-123 was not listed.

Estimated cost of repairing the aircraft was in excess of $3,000—not to mention downtime.

HAZARD OF ELECTRO-EXPLOSIVE DEVICES—All transmitters of radio, television and radar create a field of electro-magnetic energy in the space surrounding their antennas. The energy transmitted can be received by another antenna or configuration of antennas. This configuration can be the initiator bridgewire of an electro-explosive device (EED) which acts as a receiving antenna. The configuration of the wire, if just right and power density is strong enough, could pick up enough current to heat the bridgewire and ignite the primer mix. Objects around an explosive device can act as reflectors or directors and increase the energy to the receiving antenna. Maximum current received will occur when EED lead-in wires are approximately straight, their combined length being one-half the transmitted wave length or odd multiple thereof, and with the bridgewire forming the center of the load.

AFM 127-100, Paragraph 0625.5 warns personnel to take precautions when handling electro-explosive devices so as to not form a resonant dipole or loop antenna.

The number of reported cases of RF energy firing explosive devices are few. To fire an EED it would be necessary for the initiator or the lead-in wires connected to it to be in the field of radiation where the power density would be sufficient to cause heating of the bridgewire; the frequency being transmitted would be the resonant frequency of both the lead-in wires and the initiator, for maximum pickup of energy.

Since initiation by RF energy would be difficult to detect, very few cases have been reported. RF incidents could have occurred for which the conclusion was unknown.

To eliminate this potential hazard of inadvertent initiation of electro-explosive devices by radio frequency energy, more attention is being given to the selection of these devices. The trend of explosive design has been to produce more sensitive explosive initiators. The more electrically sensitive the explosive unit, the smaller the amount of energy required for its initiation. Engineers are at last acknowledging the fact that the hazard is real and are working to develop preven-

continued on page 28

AERO BITS

continued from page 27

tive measures to eliminate it. One preventive measure is to ensure that all electro-explosive initiators are able to withstand a minimum no-fire current of 1.0 amp or 1 watt-dc, whichever results in the maximum energy dissipated by the bridgewire for five minutes minimum without firing or dudding.

Personnel should be cognizant of the hazard associated with RF transmitters and heed the safety precautions in AFM-127-100 while handling electro-explosive devices.

Alvin G. Laird
Electronics Engineer
Explosives Safety Div.
2705 Airmunitions Wg, OOAMA
Hill AFB, Utah

OLD OR NEW MODEL. Can you tell the old model CRU-60/P manufactured prior to 1 November 65 from the new and improved model manufactured since 1 January 66? Same company names appear on them but there are many improvements. OCAMA is revising Tech Order 15X5-4-1-101 to condemn Gilco connectors received prior to 1 November 65.

The hose on the new model Gilco is nearly the same color as the oxygen mask hose. The hose clamps are of stainless steel. Turn it over and the back plate should not have a teardrop slot. The female port on both models have been extended one-half inch to prevent shoulder harness hang-up. Now you know the new from the old. It pays to stay up to date.

Maj. George C. Braue
Life Sciences Division

FUNNY FUEL. Shortly after refueling at a civil airport, a U-3 was started up and taxied out for runup prior to takeoff. While the crew was copying the ATC clearance the right engine quit and could not be restarted. Then the left engine began to run rough and was shut down. Reason: Both main fuel tanks and fuel lines contained approximately 50 per cent water and 50 per cent fuel.

Later inspection of the operator's fuel servicing system found it satisfactory. However, the operator said that on the day the aircraft was serviced the drain holes in the walkway on top of the refueling unit were stopped up. This allowed water to stand in the enclosed walkway and some entered the tank around the manhole cover. The night before there had been a heavy rain.

If this crew had not been delayed by the ATC clearance there could very well have been a serious accident. It is recommended that crews of aircraft serviced with fuel at other than military bases make a fuel check for contamination. Preferably this check should not be made for at least an hour after servicing. ★

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 251-209/1

WELL DONE

LT COLONEL EDWARD C. HECKMAN, JR

4780 AIR DEFENSE WING, PERRIN AFB, TEXAS

Lt Colonel Edward C. Heckman, Jr., flying a T-33, was acting as a high altitude traget for a TF-102A on a student training mission. Approximately 10 minutes after level-off at 39,000 feet, Colonel Heckman felt an explosion in the aft section of the aircraft, accompanied by a loss of engine RPM and EGT. He immediately activated the gangstart system, but the RPM and EGT continued to decay to zero. Realizing that further attempts to start the engine would be futile, he turned off the gangstart switch and stopcocked the throttle. He then declared an emergency and turned off all electrical equipment except the UHF radio. The GCI controller gave him an immediate vector toward Perrin. The TF-102 intercepted the T-33 and reported that there was no fire or major aircraft damage. While passing 28,000 feet, it became evident that it would be impossible to glide to Perrin. The controller advised him that Paris, Texas, was approximately 30 miles away and had a 4500-foot runway available. Colonel Heckman elected to attempt a flameout landing and requested that GCI vector him toward Paris and check to see that the runway lights were turned on because of the impending darkness. As he continued his descent, the canopy and windscreen frosted over, forcing him to continually divert his attention to scraping the canopy to improve visibility.

Colonel Heckman lowered the landing gear by the emergency system at 6000 feet and completed a normal flameout pattern. Touchdown was made approximately 300 feet from the approach end of the runway at 120 knots. Colonel Heckman utilized maximum braking and opened the canopy at approximately 80 knots, but was unable to stop on the runway without blowing the tires. The aircraft stopped after traveling one foot into the grass at the end of the runway. Colonel Heckman's thorough knowledge of the aircraft systems and ability to cope with the situation enabled him to successfully land the aircraft on a marginal runway under very unfavorable conditions caused by impending darkness and reduced cockpit visibility. WELL DONE! ★

DON'T BLOW YOUR

HOTHEADS MAKE MISHAPS

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FLYS

AEROSPACE SAFETY

UNITED STATES AIR FORCE

NOVEMBER 1966

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FALLOUT

PHOTOGRAPHS

The Rex Riley poster on the back cover of the September issue of AEROSPACE SAFETY shows a pair of misplaced pliers as the cause of a major F-100 accident. Result: one fatality with a loss of over $600,000.

On page 19 of the August, 1965 issue of AEROSPACE MAINTENANCE SAFETY is a picture of this same aircraft. Cause of accident: a steel bolt was dropped in the fuel pump area, resulting in damage to the fuel system components leading to fuel starvation and a crash! The article points out that the pilot ejected, indicating no casualties. A loss of some seven hundred thousand dollars was reported.

Which article is correct?

A couple of Non-Maintenance Personnel

Both are correct. Here's why:

1. The price of the F-100 varies by model and other factors.

2. Because our picture file is so limited, we sometimes are forced to use a photograph of an appropriate type of aircraft even though it is not the one actually involved in the particular incident. This was the case detected by a couple of sharp-eyed readers. Incidentally, this is a good chance for us to make a plea for pix. Anyone who has any aircraft photos of any kind can do a favor by sending same to ye editor. Thanks.

CROSSWIND LANDING

Reference the article "Crosswind Landings," page 16 of the August issue. From a purely semantics standpoint, the next to the last sentence in the lead paragraph is not true. A crosswind at traffic pattern altitude would only manifest itself in drift, and as such would not kill anyone. Admittedly, if the aircraft had been on the ground, lack of correction for crosswind could have resulted in weathervaning, groundloop and all those other embarrassing things, the more violent of which could lead to fatality.

In the case outlined here, the crosswind didn't kill the pilot; but his rather gross lack of planning did — in conjunction, of course, with possible loss of face when he went around. Pilots don't earn the reputation as "the world's best" by downwind legs that are so close to the runway they require extremely tight turns onto final and even "airplane aimers" can usually recognize an impending stall. The rest of the article reads fine.

Lt Col J. A. Talbot
Chief of Safety
61 Mil Alft Wg (WS)
APO San Francisco 96553

Glad you approve.

Sorry

On page 25 of the October issue, in Missilanea, Major Herman F. Profit is mentioned as the name of the Project Test Officer. Our apology to the good Major. His name is PROBST.

SUPERVISION

Lt Col Samuel R. Smith, Directorate of Aerospace Safety

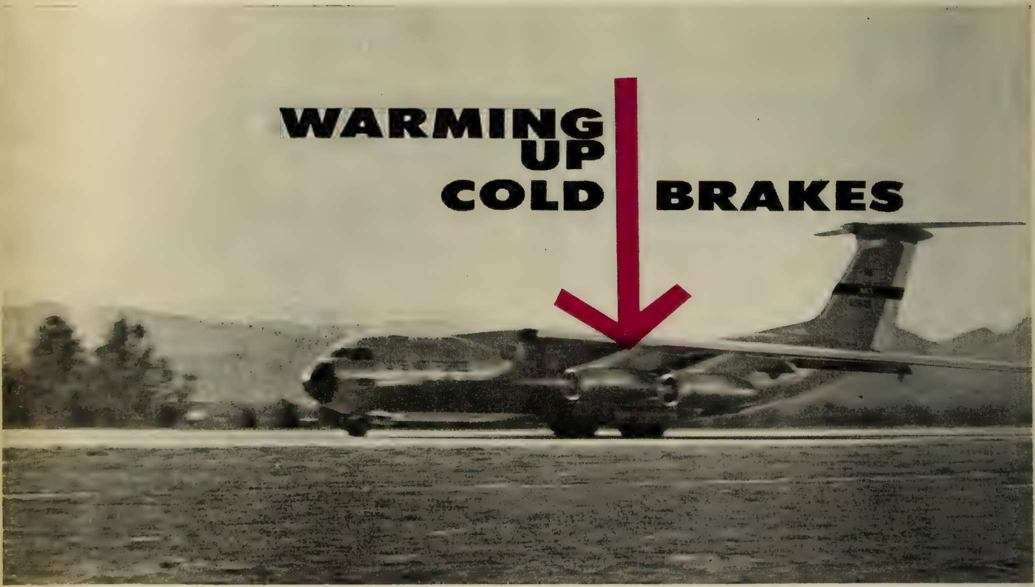
High level management is concerned that adequate supervision is lacking throughout the Air Force. Although supervision is now found as a cause factor in many accidents or incidents, many more accident reports indicate the possibility but do not list it as a cause factor.

The SEA situation requires 100 per cent manning by our best pilots and maintenance personnel if we are to get the job done. This has, at many bases, placed the maintenance manning below desired levels, both in numbers and skills. At the same time, training requirements have been increased to provide pilot replacements in SEA. This all adds up to the need for more aggressive supervision than ever before if we are to maintain our excellent aircraft accident rate.

When an airman is directed or allowed to do a job for which he is not qualified, without proper equipment, or under conditions such that he cannot reasonably be expected to do an adequate job, supervision can easily be cited as a contributory cause factor.

Aircrew members are in an excellent position to assist their commanders and maintenance supervisors in correcting unsafe practices on the flight line. To be of the greatest assistance, they should know Chapter 8, AFM 127-101, Accident Prevention Handbook. During safety surveys conducted by the DIG/IS Flight Safety Division, findings of violations of procedures outlined in this chapter are numerous. Corrective action, before it is entered in an accident report, may save lives and an aircraft. ★

WARMING UP COLD BRAKES



By D. L. Herring, C-141 Senior Design Engineer
(Reprinted from AirLifters, Lockheed-Georgia Co., October 1966)

When brake pressure cannot be applied to a particular wheel in a main landing gear system on an airplane, you get what is called a "cold brake."

Derivation of the term is clear — after an airplane lands, if the brake is not warm, it is apparent that no friction has been generated in the brake, that it has not been braking.

Occurrence of cold brakes on the C-141 has been traced to a component of the airlifter's hydraulic system, a shuttle valve.

The eight multi-disc brakes on a C-141 can be supplied hydraulic pressure from either of two hydraulic systems. The two-system capability is provided with a single, common hydraulic line to each brake, running from a point inside the fuselage. Such a design makes for greater accessibility for maintenance.

A shuttle valve, at the junction of the Nr 2 normal and Nr 3 emergency brake system lines and a line to a brake, allows the two systems to be used independently. (See Figure 1.)

If the Nr 2 system is used, pressure in the Nr 2 line forces the spool in the shuttle valve to close the Nr 3 line; thus, fluid from the Nr 2 flows into the line to the brake. Conversely, if the Nr 3 system is employed, pressure in that line pushes the spool in the opposite direction to close the Nr 2 line.

In the Nr 2 normal brake system, upstream of each shuttle valve, there is a hydraulic fuse which operates in a manner similar to an electrical fuse in a residential wiring system. The C-141 fuse is a safety device, designed to close if hydraulic fluid starts to flow above a certain quantity at a certain minimum rate.

For example, if a C-141 brake line is broken or ruptured, allowing hydraulic fluid to escape, the fuse in that particular brake line closes, sealing the ruptured line. Thus, only a few cubic inches of fluid are lost, which does not affect the operation of the hydraulic system. The other seven brakes still function normally. Once a fuse is closed, it can be re-opened only by reverse flow, thereby providing a positive seal to close a broken line.

Field reports about cold brakes on the C-141 pointed out that no external leaks that could have caused a fuse to close had been found, and that a cold brake could be made to work again only after the fuse had been reset, or opened. Although the shuttle valves were believed to be leaking fluid between hydraulic systems Nr 2 and Nr 3, early functional tests at Lockheed-Georgia indicated that the valves would not malfunction or leak enough fluid to cause the fuse to close.

However, the Nr 2 and Nr 3 hydraulic systems also serve other functions besides the brakes, such as the spoiler actuators. So, shuttle valve spools could be subjected to varying return line back pressures from both systems simultaneously, during both inflight and ground operations (See Figure 1). It was believed that return line pressures could vary enough to cause the shuttle valve spool to hang up in the center position.

Additional bench tests at Lockheed, simulating various return line pressures on the shuttle valve, verified that the spool could be made to hang up in the center position, and that then the valve would leak at a rate sufficient to cause the fuse to close.

In such a situation, if the return line pressure was greater in brake system Nr 2 than that in Nr 3, fluid flowed from Nr 2 to Nr 3 in a quantity and at a sufficient rate to cause the fuse in that particular line to close. Consequently, since brake pressure could not be applied to that particular wheel, that wheel would have a cold brake.

If the pressure from brake system Nr 3 was greater than that of Nr 2, transfer of fluid from Nr 3 to Nr 2 could take place. If that happened, in sufficient quantity, system Nr 3 was lost. While Nr 2's braking power was not adversely affected, the fluid overflowed the Nr 2 reservoir.

To prevent recurrences of cold brakes on the C-141, a new shuttle valve has been incorporated. Regardless of the position of the spool in this new valve, it prevents transfer of fluid between systems.

The new valve was installed on aircraft Nr 64627 at Travis AFB, California, and on Nr 64647 at Tinker AFB, Oklahoma. Combined reports from Travis and Tinker show that to date (October) the two aircraft have compiled a total of more than a thousand landings with no cold brake problems.

All other C-141s are being retrofitted with the new shuttle valve, in accordance with TCTO 1C-141A-1026, to help stamp out "cold brakes." ★

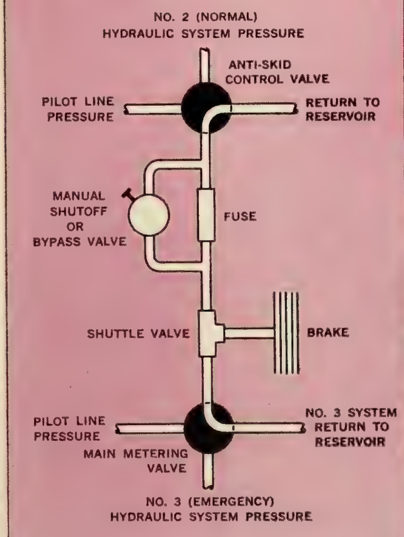


FIGURE 1. TYPICAL HYDRAULIC BRAKE SYSTEM
(VALVE POSITIONS SHOWN WITH NO BRAKES APPLIED)

Check...and double check

Robert B. Shanks, Directorate of Aerospace Safety

During a recent F-104 accident investigation, a hydraulic quick disconnect was found only partially engaged. Teardown revealed that the nipple end of this disconnect could be unscrewed by merely twisting the disconnect when it was assembled but not locked.

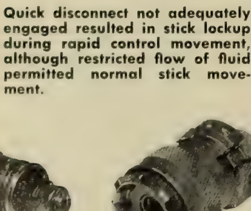
What happens is this: the socket can grip the nipple sufficiently to unscrew it when the nipple is rotated relative to the socket. When this occurs, the disconnect won't lock. In the F-104, however, it can be held in place sufficiently tight to prevent leakage on a return line, but in a pressure line, there is sufficient pressure to cause the disconnect to spray the oil out.

The return line is the one to watch out for. It is possible to assemble these disconnects so that they do not leak and yet will pass a small quantity of fluid so that normal stick movements can be made. But, if rapid stick movements are attempted, the stick will lock up, because of the nipple obstructing the free passage of fluid. In an emergency this could contribute to an accident. Don't overlook the quick disconnects. Be sure they are locked together and properly safetied.

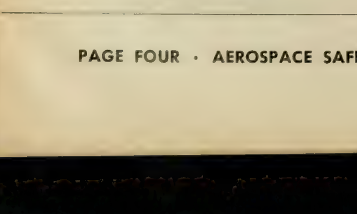
While we are talking about F-104 aircraft, let's not overlook the bleed air line. In the F-104, the bleed air line is two inches in diameter and runs along the top of the fuselage. Any time any maintenance is done in the fuel tank bay, it may be necessary to remove a section of this line. If the couplings are not properly torqued, during reassembly there is no way of telling this until some damage is done to the aircraft. If the coupling is left disconnected, the inspection covers will probably blow off on engine run up.

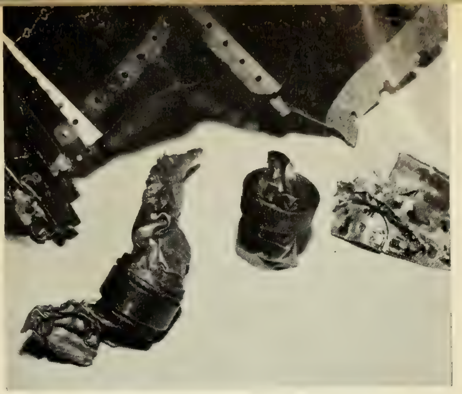
In one case, a coupling evidently began leaking without serious effects until after the aircraft had leveled off in flight. The pilot had noticed that the air conditioning wasn't working properly, then the stick began to shake, the APC light came on, the automatic pitch control indicator went all the way over to 5. This is what happens when the 501, or "C" phase, fuse in the 3 axis amplifier blows. Right after this a terrific over-pressure occurred in the cockpit. The nozzle position indicator was spinning and wisps of smoke flowed gently forward from behind the seat. Then suddenly the whole cockpit filled with smoke.

None of the instruments were visible except for a red glow from the fire warning light. The stick jerked and the aircraft nosed down. The pilot tried to level off, but the stick was locked and wouldn't budge. He saved himself by ejecting but we lost the F-104 which completely disintegrated on impact with the hard desert soil.

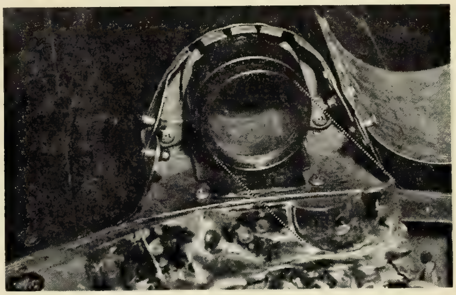


Quick disconnect not adequately engaged resulted in stick lockup during rapid control movement, although restricted flow of fluid permitted normal stick movement.





Coupling on left, in photo at right, on 2" dia. engine bleed air line still intact after crash of aircraft. Note severe distortion of stainless steel ducts still attached to coupling. The coupling to its right was found disconnected with no evidence of forcible separation and no thread damage. Photo below shows 2¼" dia. circular gouge and cut on fuselage upper skin which investigators matched to open end of the bleed air line on another aircraft.



If it hadn't been for the tell-tale scorching of zinc chromate paint, we might never have found the accident cause. However, there near the burned paint was an open coupling with undamaged threads. All of the other couplings had remained connected even though the air duct was mangled. Next we found a perfect imprint of the open end of the duct on a piece of aircraft skin that had been right under the coupling.

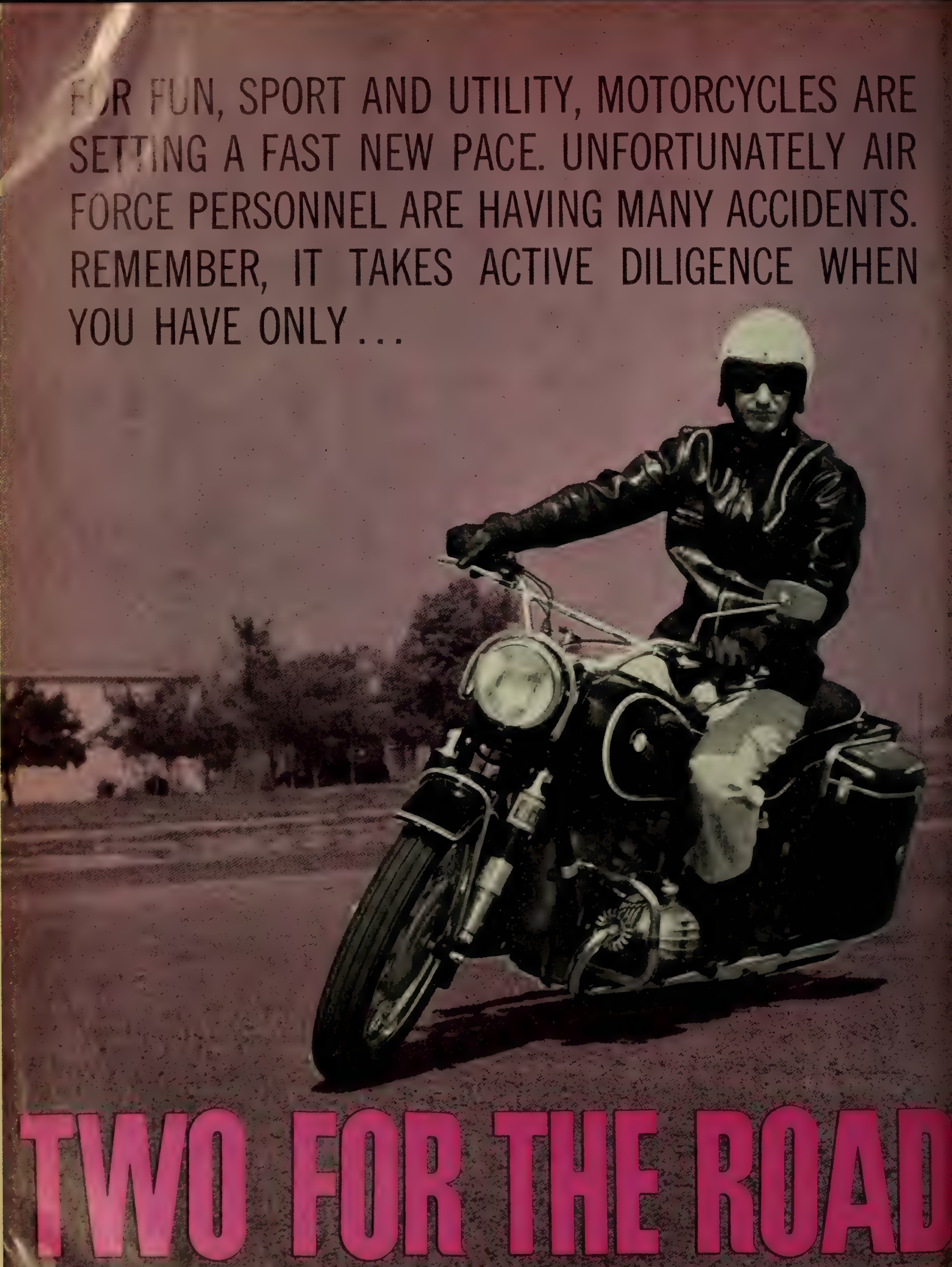
What had happened was that the coupling became separated in flight and had released hot air at about 500 degrees F. This air went down the space between the bleed air duct and the aircraft's skin until it reached an elbow where only a thin rubber boot separated it from the space over the top of the auxiliary fuel tank. Of course, with about 200 PSI pressure in the bleed air duct, the rubber boot wouldn't last long once the duct came open. Hot air blowing on top of the auxiliary fuel tank, where a harness connecting the yaw damper gyro to the 3 axis amplifier was routed, accounted for the flight control antics that were similar to the blown fuse in the 3 axis amplifier. A grounded or broken "C" phase wire in this harness would cause these symptoms. In fact, this was the only warning the pilot had other than poor performance of the air-conditioning package.

In the A and C model aircraft (single seat) the bleed air shutoff valve is next to the air-conditioning package in the electronic bay. In the B and D models (twin seats) there wasn't room for it there, so it was moved back into the engine bay next to the primary heat exchanger. Unfortunately, the accident aircraft was a "C" model so there was no possible chance for the pilot to shut off the air supply. Had it been a "B" or "D" model, then by going to ram air the pilot could have shut off the bleed air and possibly brought the aircraft home, provided the stick did not lock up.

Since there had been some maintenance done on this aircraft prior to the final flight, it is probable that the aircraft was run-up and ground tested and cleared for flight without critical inspection or access panels having been double checked. If the access panels over the quick disconnects had been double checked, the unsafetied condition of the disconnects might have been discovered and corrected. Similarly, if the access cover to the bleed air duct at station 335 over the auxiliary fuel tank had been removed, the burned zinc chromate might have been detected and the loose connection in the duct tightened before any serious damage was done.

There must be a lot of good ideas on how to check and double check after PE or other maintenance that will prevent loss of an aircraft because of maintenance error. If you have one, and it's not already in the T.O.s, send it in as a suggestion and get some recognition for yourself and your outfit. ★

FOR FUN, SPORT AND UTILITY, MOTORCYCLES ARE SETTING A FAST NEW PACE. UNFORTUNATELY AIR FORCE PERSONNEL ARE HAVING MANY ACCIDENTS. REMEMBER, IT TAKES ACTIVE DILIGENCE WHEN YOU HAVE ONLY . . .



TWO FOR THE ROAD

Airman Pete Petosky withdrew $300 from the credit union last week, leaving a balance of $6.71. Then he took the bus downtown. When he returned to base he was riding a shiny new motorcycle and had joined that vast group of two-wheel enthusiasts that has multiplied like Texas jackrabbits during the past few years.

When he went to have his bike registered for on-base operation, the airman discovered that getting the base permit wasn't a simple matter of filling out a form. First, the bike had to be thoroughly inspected and certified. Then there was a short orientation followed by a written test. If he could make 80 per cent or better, Airman Petosky would be awarded a base decal.

Why so much to-do over a mere motorcycle? The record is the answer. During the first six months of this year there were 257 accidents (reported) involving two-wheel vehicles operated by Air Force personnel. And, probably reflecting the growth in popularity of these machines, there were 33 fatalities during the first six months against an average of 26 per year for the past three years. Not only are these fatalities costly, but the number of man-days lost due to accidents has reached serious proportions (Figure 1).

Analysis of two-wheeler accidents over a three-year period reveals nothing particularly unusual. They occurred about when, where and to whom most of us would predict (Figures 2 and 3).

What got us interested in this subject was the figures turned out recently by the numbers shop. When we discovered the number of accidents that have been occurring, the deaths and that last year motorcycle accidents cost the Air Force 12,542 man-days, we decided to pass on a few of the facts and figures. We learned that motorcycle (the Air Force lists three types of two-wheel vehicles — motor scooters, motorbikes and motorcycles; for clarity, we're using the words motorcycles or two-wheelers in this article) sales in this country have grown astronomically during the past six to seven years. One manufacturer sold only 181 vehicles in the U.S. in 1959; last year Americans bought 275,000 from this company alone.

Apparently Air Force personnel have been acquiring the two-wheeled vehicles at a similar rate. By far the greatest number of these are in the popular $300 to $400 price bracket. A dealer told us that he sells a large number of machines to Air Force personnel and that most of the approximately 50cc, $300 types go to airmen and officers who use them as transportation to and from work. The bigger, faster, more expensive bikes are bought principally by single men who probably do not own an automobile.

Many of the smaller motorcycles serve a dual purpose — transportation and recreation. The trail bike has become popular during the past few years, and it is not at all unusual to see riders on trails in our national parks on two-wheeled steeds rather than on four-legged mounts.

To the uninitiated, the motorcycle looks dangerous and many motorists consider them a nuisance and a hazard on the highways. Much of this attitude has been engendered by irresponsible cyclists and the antics of motorcycle gangs that have sprung up around the country. For these the reputation they have acquired is well deserved. Unfortunately, there is a tendency to tar all two-wheel riders with the same brush. This has resulted in resentment toward cyclists which is manifested occasionally by motorists determined to give them no quarter on highways and freeways. Cyclists have been deliberately edged off the road,

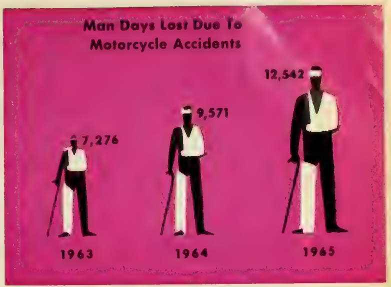
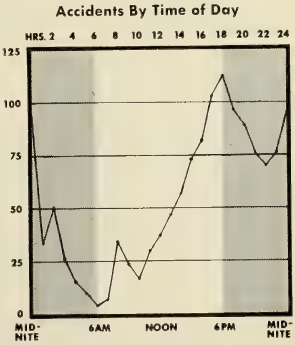
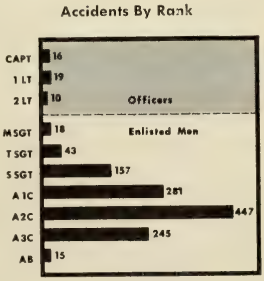


Figure 1

By **BOB HARRISON**

Figure 2





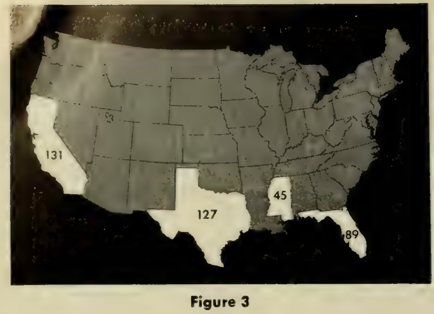


Figure 3

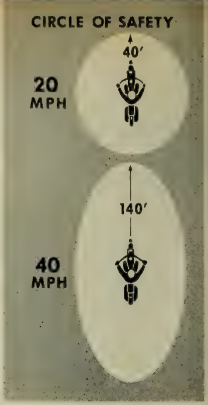


Figure 4

Circle of Safety—as speed increases, circle elongates to provide safety cushion around cyclist.

sometimes with catastrophic results.

How safe is it to ride these machines? Indications are that they are not inherently dangerous — in fact, they have some points in their favor — but that if an accident occurs, they are more dangerous than an automobile simply because they do not provide the protection that a car body affords. There is no question but what the cyclist must be a more careful driver than the average automobile driver. Loose dirt, water, oil and grease on the road surface, ruts and railroad tracks, which normally present no hazard to an automobile, can be dangerous to a bike rider.

Add these to all of the hazards that plague automobiles as well as cycles and it becomes apparent that the cyclist must be more alert, more careful and more considerate of other motorists than the average driver. For example, tailgating, particularly on freeways, frequently results in front-rear collisions. These are seldom fatal to people in automobiles, although they result in many injuries, expensive damage and often huge traffic jams. To the motorcycle rider, tailgating that results in an accident can easily be fatal.

Defensive driving, long preached by law enforcement agencies, the National Safety Council and the Air Force, is a *must* for the cyclist. Two airmen lost their lives in May in a headon collision with an automobile. The accident occurred at the crest of a small rise when the driver of the automobile drifted into their lane. The driver of the car, who was allegedly under the influence of alcohol, has since been charged with manslaughter.

For the cyclist, skill is essential. This doesn't mean that he has to possess any unusual abilities or skills, but many accidents occur to riders who are not familiar with the equipment or who have had little experience.

See and be seen is a cardinal rule for automobiles, aircraft, boats and any other vehicle and is particularly important to cyclists. Accidents and a far greater number of near-misses occur because automobile drivers fail to see small two-wheeled vehicles. A cardinal rule for cyclists is to stay out of automobile drivers' blind spots. Bright colored, easy-to-see jackets and reflector helmets are recommended, and some authorities suggest the motorcycle headlight be on at all times, day and night.

Safety equipment is essential. Recommended are gloves, boots or high-top shoes, glasses or goggles and, by all means, a safety helmet. Gloves should be long enough to prevent wind from entering the cuffs of the jacket. Glasses or goggles should be secure so that they won't blow off, shatterproof and ventilated so that they won't steam up to cut or distort vision. Many helmets are available, but get a good one. A satisfactory helmet can be purchased for about $20 to $25 — even less in the BX — although prices go up to the hundred dollar mark. But a word of caution: watch out for cheapies. AFR 127-5 makes the wearing of helmets on base mandatory. It also specifies acceptable colors and outlines general structural requirements.

PASSENGERS

The first rule here is don't carry any passengers until you are thoroughly familiar with your motorcycle and have enough experience to be a competent driver. Once you reach this stage, it is permissible to carry passengers but you must observe certain precautions: Be sure the passenger

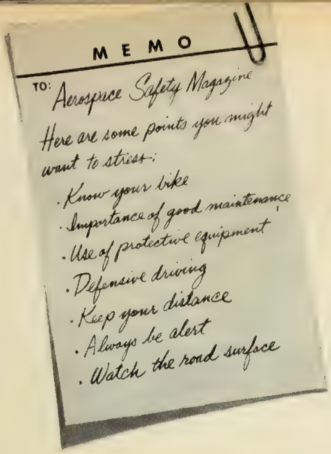
- Holds on to the handle or seat strap when the vehicle is in motion.
- Keeps his feet on the footrest at all times.
- Is briefed on leaning with the driver and against holding his body rigid. This makes the vehicle hard to balance.
- Avoids contact with the hot muffler.

A concept that applies not only to two-wheeled vehicles but to automobiles as well is the "Circle of Safety." This simply means that one should operate his vehicle in such a way that he keeps traffic situations far enough away to protect himself from them as they develop. In other words, keep a safe distance behind vehicles ahead, use the rear view mirror and look around to keep from being overtaken from behind either while moving or in case a sudden stop or maneuver is necessary. Keeping clear of hazards and obstacles on both sides completes the circle (Figure 4).

The motorcycle has become a significant factor in traffic nationwide and is being recognized as such. In the near future we can expect more attention to be given to these vehicles by both military and civil authorities. This is reflected in the Air Force by a study that is being made by the Ground Safety Division of the Directorate of Aerospace Safety which is expected to lead to a new safety policy and standards. A segment of the new USAF Traffic Safety Training program is devoted to this subject, and a new training film is scheduled to be made in the future.

Meanwhile, the bikes are growing in numbers as owners discover the joys of exploring the back country where automobiles are impractical or can't go at all, their economy of operation, the fun they can provide.

But the hazards are there, too. As one safety officer said: "There are those who have fallen and there are those who are going to." There will be falls and collisions with the resultant lumps and bruises, occasional broken bones, other injuries and deaths. Safety people will continue to develop accident prevention methods and techniques but the final responsibility rests with those who ride two-wheel vehicles. ★

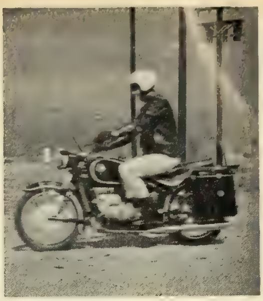


MEMO

TO: Aerospace Safety Magazine

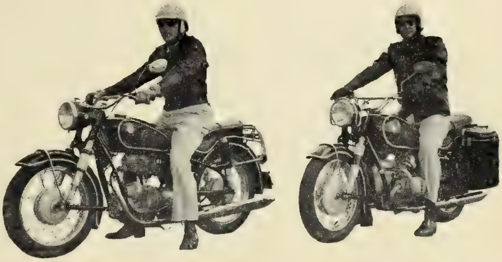
Here are some points you might want to stress:

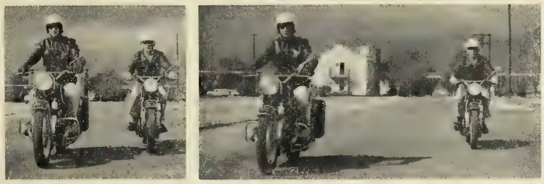
- Know your bike
- Importance of good maintenance
- Use of protective equipment
- Defensive driving
- Keep your distance
- Always be alert
- Watch the road surface



Smart rider (above) watches road conditions. Rocks, sand, oil and water can cause a fall.

Well dressed cyclists, below, wear suitable helmet, gloves, in this case leather jackets. Bright colored, easy-to-see jacket is good, too, but leather helps protect rider in case of a fall. Boots or high top shoes are better than low cuts.

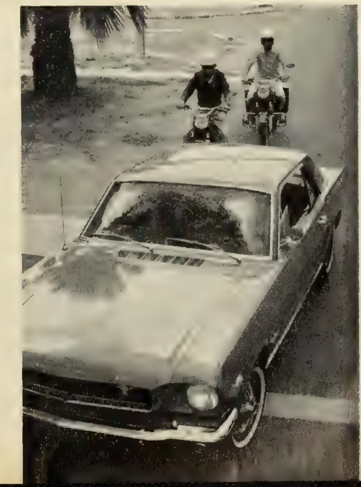




WRONG

RIGHT

Photo at left shows riders close together, nearly abreast. This inhibits maneuverability. Better spacing fore and aft, laterally, shown at right.



Auto begins right turn. Cyclists are in driver's blind spot, too close and could be forced into obstructions or curb on a city street.

PHOTOS BY MSGT BOB PARKER

Would you believe...?

Maj Bruce D. Jones, Chief of Safety
4510 CCT Wg, Luke AFB, Arizona

WOULD YOU BELIEVE, the difference between an incident and an accident is the first two letters of the word, especially when it comes to abort procedures?

WOULD YOU BELIEVE, that you, the pilot, in many of the cases have some control over which two letters are placed at the beginning of this word? One of our pilots proved this last week when he successfully aborted an F-100 when a birdstrike stalled his engine at nose wheel liftoff. He made a perfect abort and stayed out of the barrier. The brakes were not even overheated.

WOULD YOU BELIEVE, we have pilots that still try to take off with improper trim? Makes for a thrilling abort or takeoff but proper procedures can avoid these seconds of sheer terror which are injected in the hours and hours of what some people have referred to as boredom.

WOULD YOU BELIEVE, my subject is aborts? An abort, for bold face procedures, means not taking off. But missions can be aborted anywhere at anytime and several different ones will be discussed.

WOULD YOU BELIEVE, we still have pilots today who want to try a second takeoff after they have aborted their first one?

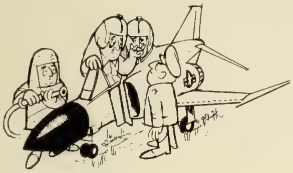
WOULD YOU BELIEVE, we also have pilots who consider the mission so important they take aircraft that are not in good condition? A T-33 recently launched with a bad radio; luckily his destination picked him up and he got in on guard channel. He didn't abort because his mission was too important: parts pickup. His radio problem — blower cooler was missing off the radio.

WOULD YOU BELIEVE, another pilot had such an important mission he took off without oxygen because he was going to remain below 10,000 feet? Fumes entered the cockpit and he attempted a Precautionary Landing Pattern. He missed the PLP and had to bail out. Neither of these pilots aborted his mission. Pilot error dominated the board findings in the latter case, and we lost one combat aircraft.

WOULD YOU BELIEVE, a lad that had two flameouts on the ground, restarted the engine a third time at an overseas base, and was still going to try to fly the bird? Someone finally chocked the aircraft after the third flameout. In another case, a troop was convinced after the first flameout that he wasn't going anywhere in his bird. He did attempt to assist in the trouble shooting to find out if there was a cockpit goof but made no attempt to go any further.

WOULD YOU BELIEVE, we had a number four lad who had his mind made up to take off and despite his flight leader and element leader aborting, mobile control giving him abort instructions, he took off anyway? Luckily he didn't ding or kill his flight leader, but it was another one of those you wouldn't believe.

WOULD YOU BELIEVE, a pilot had an unsuccessful abort in an F-100 and received pilot error in the accident because his speed brakes were down? No tail hook barrier was available, and the old barrier couldn't stop him. Some people believe retarding the throttle back and pushing the speed brake switch forward is an awkward movement and could be forgotten in the few seconds an abort requires. Visit mobile and notice the number of F-100s touching down with speed brakes out.



WOULD YOU BELIEVE, an F-105 just hooked the approach end of the barrier at a TAC base? He had been told the tail hook was down and smartly caught it on the fly while landing. Bent another combat aircraft.

Here's an interesting case. A captain was taking off and airspeed stopped increasing so he aborted. Stores weren't jettisoned and barrier was engaged at about 100-120 knots. The old barrier didn't hold and a major accident occurred. The pitot static system and the barrier took the blame, but WOULD YOU BELIEVE the pilot possibly could have saved this combat aircraft by proper abort procedures? Then another base had an attempted abort but the pilot never got it out of afterburner and back to idle. He hit the BAK-6 barrier at 200 KTS without jettisoning tanks or deploying the drag chute. He went through two barriers and covered 3078 feet more on the nose. Dirt finally snuffed out the engine and the pilot evacuated the wreckage safely. He thought he had engine failure, had idled the engine, and deployed the drag chute. Simulator tests later showed that it takes pilots 4-16 seconds to evaluate a take-off emergency and take action. Seventy-five per cent of the pilots had at least one step out of sequence. Twenty-five per cent did it right. In the real abort the pilot had six seconds to perform all functions correctly. Unfortunately he only accomplished one step, lowering the hook.

WOULD YOU BELIEVE, that 11 months later another pilot aborted at this same base, due to low accel check airspeed? He also failed to bring the throttle out of A/B. This particular base had learned its lesson well and mobile called him to get throttle to idle. He lost only 60 knots airspeed in 6500 feet of runway, so the seconds and runway under you go very fast.

In summary I HOPE YOU BELIEVE:

- No mission is important enough to take an aircraft with a known malfunction or problem.
- Knowledge of abort procedure is fine but simulator practice and perfect abort procedures are a part of our training requirements.
- Briefings should include barrier capabilities; cross country flights are a good place to exercise your alert mind on what barriers are available and what they can do for you when proper procedures are employed. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC) Randolph AFB, Texas

Q A pilot receives clearance for a specific published high altitude penetration and approach while inbound to the destination fix at an assigned altitude *higher* than the published initial penetration altitude. Does clearance for the penetration and approach constitute clearance to immediately begin descent to the initial penetration altitude? Can the penetration be initiated from an altitude higher than that published?

A The answer to the first part of the question is yes. A descent to the initial penetration altitude can be started immediately, unless otherwise directed by Air Traffic Control. (NOTE: If the initial penetration altitude is a flight level such as FL 180 or FL 190, make sure it is usable according to local altimeter setting, e.g., FL 180 is only usable with current altimeter setting 29.92 or higher.)

The answer to the second part of the question is also yes; however, a pilot should use judgment before commencing a penetration from an altitude higher than that published. The ability to comply with penetration airspace limitations (teardrop) or subsequent altitude restrictions (straight-in) should be considered by comparing altitude to be lost with distance, ground speed and rate of descent. When arriving at the initial approach fix at an altitude considerably higher than the initial penetration altitude, e.g., FL 260 with published altitude FL 200, descent to the initial penetration altitude should be performed in a holding pattern after receipt of appropriate ATC clearance.

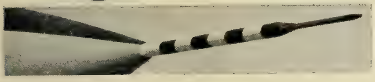
Q Since AFM 51-37 defines a circling approach as a visual flight maneuver, when can I descend below published circling minimum altitude during a circling approach?

A One point must be thoroughly understood concerning circling approaches, i.e., a circling approach is a *visual* flight maneuver; it is used when the instrument approach is completed to align the aircraft with the landing runway. With this firmly in mind, descent below the minimum altitude guaranteeing obstruction clearance rests solely with pilot judgment. At the time the decision is made to commit yourself to the circling approach there should be no doubt that the aircraft can be maneuvered visually for a landing.

POINT TO PONDER

The old question of when to start a missed approach from a precision approach still seems to be around. AFM 51-37 states, "The missed approach must be performed when visual references are insufficient to land from a precision approach at the published minimum altitude." The debate centers around the altitude lost during the transition of the missed approach and the fact that there may be a momentary deviation below the prescribed minimum altitude. The factors of speed, weight, and vertical velocity, plus pilot reaction time, altimeter errors, and position relative to centerline and glidepath cannot be ignored. All of them must be considered by the pilot prior to, and during any precision approach in minimum weather conditions. Our position in this matter is simply this: The published minimum altitude is the pilot's *minimum decision height* for initiating a missed approach. It may be necessary in some aircraft to initiate the missed approach prior to the prescribed minimum to avoid contact with obstructions during the transition to a climb. Far better to see the runway on the missed approach than to realize too late that your aircraft can't pull up from a 100-foot PAR minimum without touching down. ★

COMPRESSIBILITY CORRECTION



Maj Robert J. Vanden-Heuvel
Systems Engineering Group, ASTFF
Air Force Systems Command

Students at all test pilot schools are probably exposed to the theory of pitot static instruments. Included in this course is a "thing" called Compressibility Correction. Although this correction is something to be used for most preflight cruise planning (except those fortunate Mach Jockeys), I believe that very few pilots, except those exposed to the subject at test pilot schools, know why it exists. Definitions of "compressibility error" and "compressibility correction" in the publications used by pilots are vague and misleading. Therefore, I propose to explain the error and its correction in pilot language.

In a conventional airspeed indicator, air pressure from moving (dynamic) and air pressure from altitude (static) sources combine to cause a needle to point to a certain value of knots. To bring this about, we have an aero-mechanical gadget designed to follow an airspeed equation which includes these variables. This standard airspeed system was designed to read true airspeed at sea level on a standard day (CAS=TAS). Let's not get involved with instrument or position error. You all know what they are. At altitudes above sea level, you have to apply a computer correction to CAS to obtain TAS because the airspeed indicator thinks it is working on sea level static pressure and it is not. (This turns out to be a good deal anyway because the wings think the same thing and stall in agreement with the airspeed indicator.)

Pretty simple except for one hooker. To make this relatively simple airspeed indicator it was necessary to assume that it would be operating in air of constant density. (Like the ocean.) If air were of constant density, then the pressure would vary linearly from sea level to the "surface" of our atmosphere. But, as any schoolboy pilot knows, half our air lies below about 18,000 feet. With the rest spread out to anywhere from 50 miles and up, it is obvious that density is far from constant.

Does this mean that we should throw away our airspeed indicators and start over? No. It means that we have to apply a correction to our CAS when above standard sea level conditions to account for the error caused by air being compressible. Voila! *Compressibility Correction!* Not because the plane is compressing the air. Not because molecules are packed in the pitot tube. Not because of Mach effect. Simply a correction to the airspeed equation which the airspeed indicator, by design, is incapable of solving.

Refer to either an F Factor Chart or a Compressibility Correction Chart. Note that at sea level the error is zero regardless of speed. Also note that the error is greater at 200 K and 50,000 feet than it is at 600K and 5000 feet. This should make it clear. The error is the result of getting farther away from sea level density, not because of speed. At any given altitude, the error is greater at higher airspeeds only because of the way in which the "incorrect" pressure fits into the airspeed equation.

If you did not already know, you may by now have figured out that the correction charts are universal — that one chart applies to all airplanes using the conventional airspeed system.

Why don't Mach Jockeys care about Compressibility? Because it doesn't affect the Machmeter. But that is another story. ★

Rex Riley CROSS COUNTRY NOTES

LIFE PRESERVERS. The 6486th Operations Squadron P. E. Section at Hickam has had some problems in keeping track of life preservers issued on AF Form 261. TSgt V. T. Mathis, Assistant NCOIC of the P. E. Center, asked Rex to pass on the following, and he's glad to oblige.

"We have approximately 7000 life preservers which makes numbering impractical and unfeasible. We issue an average of 100 preservers per month to transient personnel, the great majority of which are turned in to a few bases in California. It is, therefore, quite likely that we would have 30-40 vests at one particular base. Unless the receiving organizations note on their shipping documents (DD Form 1149 or DD Form 1348-1) who turned item(s) in, the issuing organizations have no way of knowing to whom credit should be given upon receipt of the equipment. The 6468th Operations Squadron, Personal Equipment Section, adheres to the policy of typing on either form: *This Equipment Turned in By* .... We also ship transient equipment within 24 hours.

"Another policy that would aid the issuing organization in locating equipment, after a reasonable period of time, is to have the receiving organization write the document control number on the margin of the post-card portion of the AF Form 261 prior to mailing. This not only informs the issuing organization that the equipment has been received, but also it is being returned and the date shipped."

DURING DOWNLOADING of a C-141, part of the cargo loaded aboard a 25K loader struck the left tip of the left aileron inflicting a cut. The report had this to say about the driver of the vehicle: "SSgt .... has over eight years of government vehicle operations without any accidents, previous mishaps or traffic citations. He has over nine years active duty and is highly motivated to obtain quality work."

With this kind of a record and reputation, why would this man allow such a mishap to occur? This question is often asked after accidents, but the answer is sometimes difficult to come by. In this case there are some answers as to why the driver misjudged the height of the load and its proximity to the aircraft.

Congestion on the ramp was much greater than usual because traffic was being diverted from another base that had been closed by an accident. This resulted in many uncontrolled passenger busses in the vicinity and many passengers in front of the passenger holding facility. In addition, the 25K loader operators were said to be pressed to accomplish loading operations within the authorized ground time.

It is possible that the driver's night vision was affected when he drove in front of a parked fire truck that had its lights on. Apparently, the area lighting was poor. Lights were available but not requested; however, an officer stated that he doubted whether there were sufficient authorized persons even if the lights had been requested, due to saturated maintenance on that particular evening.

BY GEORGE, that was a close one! A pair of F-104s taxied to the maintenance inspection area for a final check just before getting in place for takeoff. Two of the ground crew inspected each aircraft. While one man was checking the nose gear well he felt a tug at a pocket and almost simultaneously, another ground crewman heard a noise and thought he saw a puff of smoke come out of the tail pipe. Then when the inspection was completed, the first man showed the tip pins to the pilot who then taxied into number one position for takeoff.

While this aircraft was waiting for Nr 2, the crewmen got to counting the pins and discovered one short. One of the men then ran to the waiting aircraft and notified the pilot of suspected FOD. The aircraft was taxied back to the line and, sure enough, there was extensive damage to the engine.

What happened was that pins from a previously inspected aircraft were in the ground crewman's pocket and one of them was ingested into the engine. Another minute or so and the pilot may have tried to take off with a sick engine.

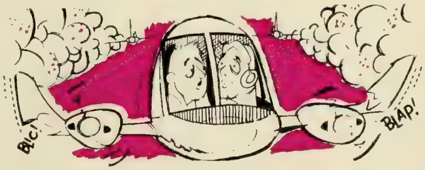
PROBABLY TOO FREQUENTLY we talk about accidents after the fact. When we discuss near misses between aircraft in flight, we're talking about accidents that didn't happen but conditions that could lead directly to a disaster.

Rex doesn't know of anything more frightening to a pilot than the thought of a midair collision. If you are lucky, you might get away with it; if you're not, even a parachute and an ejection seat won't save you. It is because of this terrible potential that we frequently mention near misses and publish accounts of some of those that occur.

The latest tale involves a pair of deuces that missed a twin engine light plane by only 50 to 100 feet. The interceptors were climbing out on a practice scramble and they passed the other aircraft between 7000 and 7500 feet. The leader of the flight of two never even saw the other aircraft, although approach control advised of traffic at one o'clock, three miles. It is doubtful that the light plane pilot saw the F-102s since he took no evasive action and he had not made a written report to FAA a week after the incident.

The weather at the time of the near miss was clear on top of a haze layer. Visibility was good—15 miles reported.

Rex doesn't like to harp on this subject, but it is barely possible that Air Force pilots, who almost always fly on IFR flight plans even in VFR weather, sometimes fail to remember that this is no guarantee against VFR traffic. And that means almost all light plane traffic. Further, Air Force pilots who have never flown light aircraft, or who seldom fly them, may not realize that there are a lot of civilian pilots to whom the hemispheric rule is something they learned in order to pass a test and have since forgotten. Therefore, you just might see a light plane flying VFR on a course of 90 degrees at 8000 or 8500 feet. And he might have his head buried deep in the cockpit while he studies all those dials and knobs on that new radio he just bought.



Add one more item—it's a rare light bird that has a transponder (probably most light plane pilots don't even know what the word means) and many of these little birds don't paint worth a darn on primary radar.

What Rex is leading up to here is this: We have been diligent over the years in stressing IFR and instrument procedures. Air Force pilots, therefore, are so accustomed to grabbing onto the gages that it is easy to forget to keep an eye outside the cockpit. This is most acute in single engine aircraft with only one pilot, who doesn't have a friend in the other seat to keep a lookout.

THE IF FACTOR

A helicopter scramble is a rapid and exacting exercise. It requires a well-trained crew, operationally ready equipment and procedures that are refined to the point where no extraneous actions slow the event. The absence of any one of these requirements is almost sure to result in inability to carry out the mission expeditiously, the possibility that it will never get off the ground, or an accident.

An HH-43 crashed earlier this year because the cable from the aircraft to an auxiliary power unit (APU) was not unplugged. Analysis of the events leading up to the mishap revealed that the scramble formula was less than perfect and, in fact, created the distinct possibility that an accident could occur. The particulars of this accident are presented here because this kind of mishap could occur elsewhere and for essentially the same reasons.

The mission was to orbit while the pilot of an F-102 with primary hydraulic system failure made an emergency landing. The flight crew consisted of a pilot, a medic and two firefighters. The ground crew was one helicopter mechanic.

The chopper took off with the cable from the aircraft to the power unit still connected. Apparently they build connectors pretty well these days, because the cable remained plugged in at both ends. But the stress was too much for the cable and it parted eight feet from the APU and traveled up into the rotor blades. Of course this sliced the cable into small pieces, and in the process, the rotor blades began to disintegrate, throwing pieces all over the lot including some that struck a WB-47 parked 450 feet away and others that damaged an HU-16 400 feet in the opposite direction.

The chopper descended, crossed a drainage ditch and touched down on the left gear, which failed. The bird then rolled onto its left side, its rotor blades flailing the ground and rapidly breaking into small pieces. It stopped with 30 feet of the cable draped around the right main gear and the bottom of the aircraft.

The primary cause was obviously personnel factor: the helicopter mechanic failed to detach the auxiliary power cable from the aircraft.

Well, that takes care of that. Next time be more careful. If you are thinking something like this, whoa up a minute. Let's take a closer look. Was this mechanic careless? Or forgetful? Or not qualified?

The Board decided that the entire crew was current, properly trained and qualified in their du-

Usually, after an accident we can apply the "if" factor: If he hadn't done that, or if someone else had done this, or "if" on and on. Perhaps the accident is the price we pay for all of the "ifs" that weren't corrected before the accident.

ties. It was also determined that the events preceding the accident were normal: the crew was prepared and briefed, clearance was proper, weight and balance okay, takeoff and landing data accurate, weather checked and as forecast, and the chopper had been properly preflighted. Sounds like a pretty good operation.

But this unit had a few problems. For one thing, they had been unable to acquire an APU with the proper output limitation. The one they were using had an output of 1200 amps, whereas an 800-amp unit was specified. Consequently, the mechanic had to stand by the APU while the aircraft was being started so that he could monitor the power output to preclude damage to the helicopter.

The duties performed by the various crewmembers during a scramble were less than perfect in that written operating instructions contained one procedure, but for a couple of months the unit had followed two different procedures, depending upon whether one or two pilots were on alert.

When there were two pilots, the medical technician stood fire guard, pulled the chocks and disconnected the power cable. With only one pilot, the medic occupied the left cockpit seat and the helicopter mechanic performed these duties, in addition to the other things he had to do. Just two hours previously, a scramble occurred in which the medic was not present and the mechanic took care of all the duties. During the scramble in which the accident occurred, the medic was in the cockpit and the Board reasoned that the appearance of two men in the cockpit may have given the appearance of a two-pilot scramble and could have confused the mechanic.

A distraction occurred when the mechanic started from the APU toward the aircraft to disconnect the cable. En route he deviated to give

THE iFACTOR

the pilot the rotor engagement signal. When the blades began to turn he gave the "droop stops out" signal and hurried to the aircraft and strapped in.

Now what was he doing in the aircraft? Because a couple of fire suppression kits had been dropped in flight, the base had requested that the kits be located in a grassy area between the taxiway and runway to preclude flying with the FSK suspended over areas populated with people and aircraft. The procedure, therefore, was for the mechanic to get in the chopper at the alert pad, ride to the FSK where he got out and attached the kit to the chopper. Then he waited there until the aircraft returned to disconnect the kit.

As contributing causes of this accident, the board pointed to the two different scramble launch procedures and the troubles with the unit having to use the wrong APU. Also they found that the procedure for turning the generator power switch off prior to detaching the cable from the aircraft failed to give the pilot positive indication that the cable was disconnected.

As a result of this accident and the subsequent investigation, the unit took certain corrective actions:

- All crewmembers received proficiency checks.
- A single scramble procedure was written for inclusion in operating instructions after the procedure was tested.
- An MD-3M power unit modified to an amperage output of 800 amps was procured.

Usually after an accident we can apply the "if" factor: *If* he hadn't done that, or *if* someone else had done this, or *if* on and on. Perhaps the accident is the price we pay for all of the *ifs* that weren't corrected before the accident. A lesson implicit in this helicopter accident is that, while procedures may be adequate for the situation existing at the time they were written, time and change create the need for frequent review and correction where necessary. One test of the sharpness and capacity of supervision is that supervisors keep their procedures in tune with the times.

★

Missilanea

BOTTLED GAS FACTS. While a cylinder of hydrogen was being used to recharge an oxygen system on an aircraft, an explosion resulted killing four men and demolishing the aircraft.

In another accident, two civilians were killed while pressurizing a surplus steel container without benefit of a pressure regulator. Last spring, an airman was killed when he transferred high-pressure gas into a common tank. In a non-injury accident, a cylinder fell from a truck, breaking off the valve. The cylinder took off like a rocket, penetrating two building walls before it stopped.

From the above, one can gather that: compressed gases in cylinders can be dangerous—when used by personnel who are careless and uninformed. If you use bottled gas, make it your business to know the equipment and the hazards, then abide by the safety regulations.

Here are some precautions which should be observed when handling bottled gas cylinders:

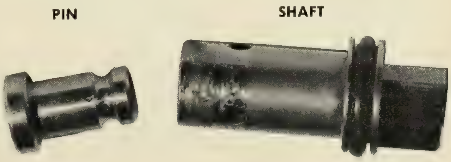
- Always read the labels to identify the contents of compressed gas cylinders.
- Return cylinders with conflicting or illegal names of contents to suppliers.
- Never force connections that *do not fit together easily*. Do not improvise by using nonstandard adapters to join connections with different threads.
- Keep safety caps on cylinders that are not in service, especially when being moved.
- Do not lift a cylinder by its safety cap.
- Never use a gas cylinder as a roller or support.
- Do not pressurize low-pressure containers with high-pressure cylinders unless a pressure regulator is used and a pressure relief valve is installed between the low-pressure and high-pressure cylinder. The pressure relief valve should be installed on the low-pressure side of the regulator.
- Protect cylinders from temperature extremes (high and low).

Know all the facts about bottled gas cylinders before you handle them. If others had known the facts, the mishaps recounted above never would have happened.

Maj R. L. Mahynske
Directorate of Aerospace Safety

LGM-30 HAPPENINGS—"A chain is only as strong as its weakest link." A trite cliché, but irrevocably true. A safety program is only as effective as its least safety-conscious member. We design thorough and detailed programs to effect safe operating procedures. They look fine on paper but if we don't give them the widest possible coverage, their effectiveness decreases correspondingly. The staff officer contributes to a safe operation, but not nearly as much as the man with the wrench. Give that man your undivided interest and attention and observe the resulting elimination of accidents.

A case in point: A recent teardown report (TDR) of an arm-disarm switch returned from the field attributed galling and pin damage to improper safing pin removal procedures. Technical Order procedures were not adhered to. The safing pin should be fully seated until a definite stop is felt, then released prior to rotating the safing pin. An additional finding of the TDR was damage to the safing pin square drive, guide sleeve, and groove inside shaft housing caused by the use of improper tools.



This is one of those things that "could not possibly happen," *but it did happen!* Training, Quality Control Evaluation and Certification, and Supervisory checks all were ineffective in spreading the word. *The man with the wrench didn't get the word.*

In YOUR unit, how many men with wrenches *still* have not gotten the word? It's YOUR safety program, and if I were you, I'd find out.

Lt Col T. F. X. O'Connor
Directorate of Aerospace Safety

DOES YOUR OUTFIT HAVE A T-29/C-131 WHICH DOES NOT PERFORM QUITE LIKE THE DASH ONE SAYS IT SHOULD? THIS ARTICLE DISCUSSES ONE PARAMETER WHICH CAN CAUSE PERFORMANCE DEGRADATION OF CONVAIR 240, 340 AND 440 AIRCRAFT.

AN OUNCE OF PREVENTION

Captain T. G. Farrell, SAAMA Service Engineering, Kelly AFB, Texas

During the routine maintenance test hop of a C-131A, the crew observed abnormal stall behavior. The aircraft entered the prestall buffet region and stall about ten knots higher than predicted in the flight manual.

In this type of aircraft, any stall is preceded by a buffet because the air does not flow smoothly over the top surface of the wings as the angle of attack is increased. The buffet produces a moderate aircraft and control system shake, followed by a change in elevator control characteristics. Thus the buffet gives the pilot an effective prestall warning.

Since takeoff, best climb and landing speeds are usually a function of the normal stall, an increased stall speed could be dangerous. For instance, if an engine were lost on takeoff at a high gross weight, the takeoff speed, best climb speed and minimum safe single engine speed should be 1.2 times the normal power-off stall speed. Since the normal stall speed is a fixed quantity for a given gross weight, an abnormally high stall speed would make the takeoff, best climb and safe single engine speeds greater than expected. An abnormally high stall speed also reduces the pilot's margin of safety during normal landing approach because the minimum recommended approach speed depends on the normal stall speed. Clearly, a premature stall is undesirable in this aircraft.

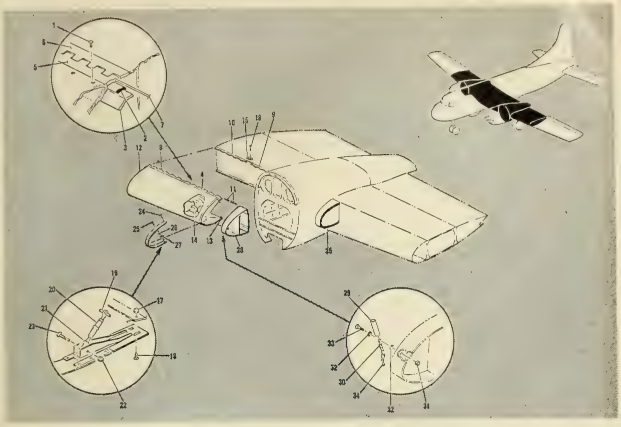


Figure 1

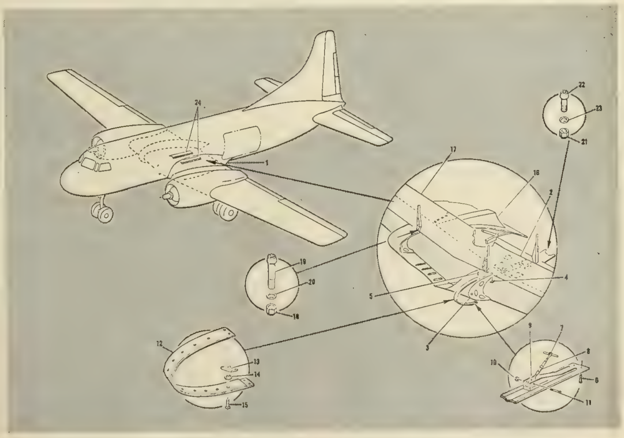
SAAMA Service Engineering was asked to diagnose the problem of this C-131. The engineers first performed an inspection of the aircraft. When the wing leading edge wrap seals were found dented and loose, the cure for this flying Samaritan became obvious – fix the seals.

The leading edges of T-29 and C-131 aircraft are removable for ease of maintenance (see Figure 1, Index 12). In the secured position, the removable leading edge is made aerodynamically clean by the leading edge wrap seals (see Figure 2, Index 12). Even a slight misadjustment of a wrap seal can result in unstable airflow across the wing, resulting in premature buffet and stall.

These wrap seals are made in three parts: The strap which actually seals the leading edge, the turnbuckle assembly which may be adjusted to remove strap slack (Figure 1, Index 20) and the lever which is fastened to the lower, front spar cap. The lever arms were originally manufactured with round, countersunk holes (Figure 2, Index 6). The fastener is shown installed through a round hole. This design is fine if the seal requires no tightening, but the round holes prevent turnbuckle adjustment. This shortcoming was recognized by the manufacturer while the T-29s and C-131s were still in production, so the lever was re-designed to have slotted holes (see Figure 1, Index 18). Note that the fastener goes through a slotted hole in the lever. The production drawing shows that a number of T-29/C-131 aircraft left the factory with the obsolete and ineffective lever design. The only difference between the old design and the new is that (1) the round, countersunk holes in the lever are replaced by the slotted holes, and (2) the lever material thickness is increased from 0.040 to 0.064 for the wrap seals of the nacelle to fuselage leading edge. Evidently the old wrap seals should have been replaced by attrition over the years. However, this has not happened in all cases, although replacements are made as required during the normal IRAN cycle.

If you have T-29/C-131 wrap seal problems, carefully inspect the seals. The strap must possess a tight, clean fit around the Wing Leading Edge. If the lever arm holes are round rather than slotted, the turnbuckles are not working for you, and the ship's stalling speed may be higher than it should be. If the nacelle-to-fuselage leading edge wrap seals require replacement, make the new lever of 2024-T4 Clad, 0.040 thick with slotted holes. This will allow continual turnbuckle adjustment until the seals have to stay in place during flight. For further information, contact the T-29/C-131 System Support Manager (SSM). ★

Figure 2



BUILD IN SAFETY

Maj Carl H. Cathey, Jr, FSO, AF Contract Management Div, Los Angeles 90045

How often have you jumped into your bird and sailed into the blue, then wondered: Why did they put this switch in this position? Why did they build this thing this way? I don't know about you, but I've asked these questions many times. It seems that all the big talk about safety runs dry about the time a bird gets to the troops. We get the machine and we have to work out some procedure so that we can live with a poor design feature or overcome some ridiculous arrangement of switches.

It was great to see the article in the April issue of AEROSPACE SAFETY, "The Safety Concept," in which Major Bill Smith explained what is being done in the major air commands, primarily AFSC and AFLC, to keep the ball rolling in getting good ideas incorporated into aircraft design. When you've seen Murphy after Murphy kill your buddies, it gets to be tiring and makes you wonder if this trip is necessary.

Project 60 is a DOD program to have one government agency interface with the contractor in a plant that produces aerospace weapons systems. In the past, there have been cases in which every branch of the services had representatives at a plant buying the same product, but they were giving conflicting directions to the contractor. Now each plant under Air Force cognizance has only one government representative with which to interface: the Air Force Plant Representative Office (AFPRO).

Out of this same program came the newest division in the Air Force Systems Command. The Air Force Contract Management Division (AFCMD) was formed in January 1965 by combining the three regions which had previously managed Air Force contractor operations in the Eastern, Central and Western parts of the United States. The Air Force, through the Systems Command and the Contract Management Division, thus has "plant cognizance" for 21 of the largest aerospace plants, where $41 billion worth of contracts are being performed. These contracts represent nearly all the major Air Force aerospace systems — as well as many major systems for Army, Navy and NASA. Once assigned cognizance of a plant, the AFPRO services contracts of all government agencies doing business there.

"You men and the crews who work for you will accept for the Air Force all of the aircraft that will be in the Air Force inventory for the next 10 to 15 years." (McDonnell Aircraft Company is an exception; the Navy BuWeps has cognizance of F-4 procurement.) That was the kickoff sentence for a recent Operations Conference for AFCMD Flight Operations Officers. The true significance of that sentence indicates a tremendous responsibility on the troops who take the birds that the contractor has proven airworthy and then put them through the envelope of their performance. The jocks of AFCMD are the last link in this chain of design, test and production of aircraft for the Air Force. If we don't catch the mistakes or poor workmanship now, the troops in the using commands will have to live with the built-in hazards.

Who are some of the jocks accepting these birds for the using commands? Well, over at AFPRO Northrop (Norair), Palmdale, California, we have ex-Thunderbirder Major Clarence Langerud chasing through the blue with new F-5s and T-38s. TAC, MDAP and ATC pilots can bet they are getting a good bird after Clarence has zipped them up, around, and then low and fast. That inverted flight pressure recovery check is a natural for solo star Lang.

How about the trash carriers down at AFPRO Lockheed, Marietta, Georgia? Major Gene Jones is the leader of the pack; he still sees the Discoverer capsules drifting down so that he could snag them from the expectant Pacific. The troops there are chasing around in

MAJOR CLARENCE I. LANGERUD, a former member of the USAF flight demonstration team, the Thunderbirds, flew more than 200 air shows with the Thunderbirds during his two year tour as a member. He was the lead solo pilot during this assignment. Subsequently, in February 1966, he was assigned to the AFPRO Northrop, Palmdale, California, as Production Assistance Test Pilot for the T-38 and F-5.

MAJOR GENE W. JONES, Chief, Air Force Flight Test and Acceptance, supervises acceptance of C-130 and C-141 aircraft at Lockheed. A former operations officer in the Discoverer Project, he organized and directed aircrew activities of 90 officers and men of the first flying squadron designated to make mid-air recovery of satellite re-entry capsules. Major Jones flew the aircraft that made two of the first three Discoverer mid-air recoveries. This led to award of the MacKay Trophy, given each year for the most outstanding military, commercial, or private flight of the year. Major Jones was a featured speaker at the 57th Annual Dinner of the Explorers Club and was elected to active membership in the club for "outstanding contribution to knowledge and exploration of space."

MAJOR THOMAS WHEELER (left), a former F-105 pilot, is assigned to the AFPRO at General Dynamics, Fort Worth, where he is an Air Force acceptance pilot for the F-111. With 13½ years rated service, he has logged over 3500 hours of flying time, including over 3200 hours in jets.

MAJOR HENRY M. WEST (right), a former acceptance pilot at North American Aviation, Inc. at Palmdale, California, was the fifth military pilot to check out in F-111 (June 1965). He is presently responsible for flight acceptance of F-111 Category II test aircraft built at Fort Worth. Major West has 12½ years rated experience, total time over 3900 hours, including over 3600 hours jet time logged in F-86, F-100, F-102, F-106, F-111 and T-33 aircraft.

the Starlifter, C-141. It gets up and moves out like a '135 after the last off-load of JP to the fighter jocks. And what do they have coming next in the crowd-carrying types? The C-5, which is something to behold. That bird will not only analyze what the inflight emergency is, but it will also remember where the part is located that will fix the malfunction, then order the part; and then finally, it has been telling the jocks what to do to take care of the immediate problem. It sounds great if it works. The gal's voice reciting the emergency procedures might even be worth the trip.

Down in Texas we have Mr. Supersaber, Major Hank West, as the Chief of Flight Operations on the F-111 acceptance at AFPRO General Dynamics, Fort Worth. Hank looked over most of the Supersabers as they rolled out of North American's Los Angeles plant and wrung them out over the Mojave Desert. Now he has been given the job of using this procurement knowledge and fighter acceptance experience down in LBJ-Land with the all-purpose F-111.

There are many more stories, but this is only leading up to the reason that AFCMD is in the business of being the last stop in the long quality production of effective and safe aerospace weapons systems. USAF Military Specification for Safety, MIL-S-38130, provides the contractor a uniform guide with which to assess potential safety hazards in all systems and subsystems and analyze the situation to reduce such hazards.

After all is said and done, the job finally comes to the AFCMD Flight Acceptance Crews to prove each aircraft is operational. In keeping with the mission, to accept all the aircraft that will be used in the Air Force inventory for the next 10 to 15 years, AFCMD has chosen the motto, "Build in Safety" as the byline to continue to buy the best. ★

CHOPPERS AND WIRES

The helicopter was on a support mission carrying passengers and cargo between missile sites. At the second stop passengers and cargo were exchanged and the pilot took off. The aircraft had traveled only about 65 feet horizontally when it struck electrical wires about 35 feet off the ground.

No flight problems developed but the pilot decided on a precautionary landing and put the UH-1F down in a field straight ahead. There was some damage: wire marks on the underside of both blades, a small tear in the trailing edge. The rotor did not appear to be damaged.

This is just one of several accidents and incidents this year in which helicopters have struck obstacles, usually wires. Some crews were lucky — like the one above — in that there was no serious damage. Others bought the farm. For example, a JUH-1F struck power lines and crashed, killing the IP, the pilot and flight mechanic. Some of the factors involved were power lines concealed behind trees, wires that were weathered and blended into the terrain making them difficult to see, the flight path was into the sun and both pilots had their visors down.

Here is a complete account of an accident in which an HH-43 crashed during a flight for the purpose of indoctrinating a newly assigned flight surgeon.

The crash occurred about 22 miles from the base after an inflight collision with electrical power lines. First part of the mission was devoted to hoist work. After leaving the training area the aircraft headed for mountainous recreation areas for orientation of the flight surgeon.

With the pilot (an IP) flying from the left seat, a gradual descent was started and a left turn begun while the pilot was pointing out route landmarks. But the aircraft descended lower than the pilot intended, which placed it at the same altitude as the electric power lines. Both the pilot and copilot saw the wires at the same time — just a few feet in front of the aircraft and too late to avoid contact. The chopper struck the wires and pitched up sharply. The pilot was struck in the face by aircraft parts or the wires, which pushed his helmet back on his head and caused facial injuries.

Now over to the pilot: "The airplane was beating vertically and horizontally. The only thing I can say is, it was severe. Certainly there was a lot of noise and the aircraft could have been coming apart at that time. I couldn't say. I never saw the wires at all. I saw the sparks and that's all. After this the aircraft was controllable. However, it was very difficult to move the cyclic stick.

"I was able to fly the airplane and I still had power. I had control of the pitch stick and I was able to keep us off the side of the hill; we were going to hit the hill, there's no doubt about that, about 100 feet up. I naturally pulled in the pitch and it raised the nose somehow. When I did, I shoved in all the rudder I could get and turned, and the nose went down and I saw we were lined up with the bottom of the canyon. I can still remember that it made me feel good because I knew we were going to get to the bottom of the canyon and it wasn't going to roll down the hill. After that it was about 30 or 40 feet off the ground yet.

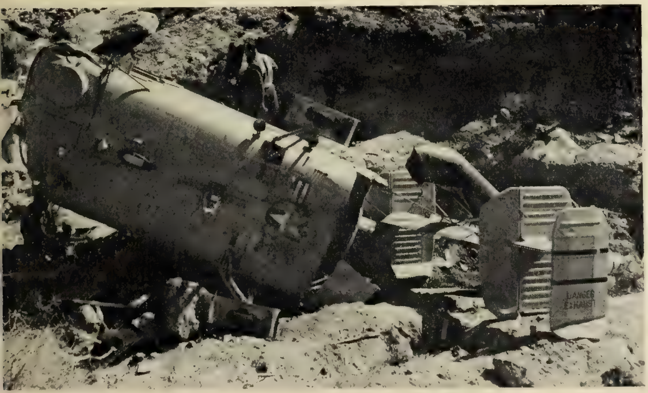
"After I had turned, the nose came up and I still had collective pitch. Although it was shaking it was somewhere near controllable. As I got the nose up I attempted to close the throttle but the locking pin won't allow you to from the copilot's seat. Many times you can stopcock the engine if you push the throttle and turn the linkage and it will close. I believe I closed it because I know I twisted it. I didn't care if I broke it. But anyway, I got the nose of the airplane up, got the forward airspeed stopped; it looked like I lowered the nose and it looked like it was coming down very gentle.

"I felt good about it. I didn't feel we were going to hit too hard. At the last minute I pulled in all the pitch there was and, as I did, the nose dropped and then we hit with the nose first.

"I realized after I got out of the aircraft that the console had broken off and it looked like it was on the cyclic stick and was probably pushing it around too."

Pilot factor was assessed because the pilot descended lower than he intended and flew into high voltage power lines. A contributing cause was inadequate supervision on the part of the operations officer/IP for permitting the flight to depart with inadequate planning and briefing. A second contributing cause was inadequately marked utility power lines.

Helicopter crashed as result of striking wires strung across canyon.



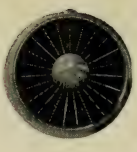
For the Army, with its many helicopters, wire strikes have become a very serious factor in aircraft accidents. In a report covering the period 1 July 1957 through December 1965, the Army had 321 reported wire strike mishaps (83 involved fixed wing aircraft) with 1965 reaching an all-time high. According to this report, there have been 32 fatalities, 94 injuries and a dollar loss of more than seven million dollars. The Army came to these conclusions relative to wire strike accidents:

They can be reduced by

- Continued emphasis on pilot education and air discipline.
- Thorough ground and air reconnaissance of flight paths.
- Pilots enroute maintaining an altitude in excess of 100 feet above the terrain, except when operational requirements dictate otherwise.

The number of wire strike mishaps and the serious potential demand an increased effort on the part of helicopter operators. Air Force regulations require that hazards to low level flying be depicted on appropriate maps. Before flying missions, pilots should thoroughly familiarize themselves with areas in which they will routinely operate. Autorotations should not be practiced except in designated areas. Maps should be kept up to date as to newly installed obstructions to flight (poles, wires, antennas). Pilots should maintain a safe altitude especially when conditions obstruct vision.

The above apply primarily to aircrews and operations personnel. But others, too, have responsibilities. Any time new facilities are constructed that might be a hazard to flight, operations should be notified at once so that maps and locally developed letdown plates can be modified and pilots briefed. ★

AERBITS

F-4C PITCH PROBLEM—On takeoff roll, at 155 KCAS, the pilot had the stick full aft but all three gears stuck to the ground. The pilot then centered the stick and re-initiated rotation. The aircraft rotated rapidly and broke ground in an extremely nose-high pitch attitude. Recovery from this attitude was made without difficulty, fuel was burned down and the pilot made a precautionary landing. Throughout the flight pitch control was very sloppy, he said, and slow to respond.

Cause: Malfunction of the stabilator actuator due to internal failure. The actuator failed all checks and the viscous damper was leaking. After repairs the aircraft flew normally during an FCF.

IF YOU SEE a couple of pilots in wrinkled clothing and needing a shave, here's what happened:

Just after selecting afterburner during takeoff roll, the pilot of the F-101 heard an explosion. He shut down the engines and stopped the aircraft on the runway. It was quickly apparent what the problem was. The armament bay door had not been properly fastened, had come open and the pilot's clothes bag and shaving kit had fallen out and were ingested by the right engine. This, of course, meant an engine change.

The mishap occurred at night and when the pilot queried the ground crewman about the door, he checked it with a flashlight. Since the door appeared to be flush with the underside of the aircraft, he signalled that it was closed. Failure to make a positive check resulted in this costly incident.

AERO CLUB—While demonstrating a forced landing to a student, the instructor allowed the aircraft to get unusually low. When he applied power to the Tri-Pacer, the engine faltered and the IP decided to land. The only damage—other than to the instructor's pride—was to the alfalfa field where the landing took place; part of it had to be mowed to allow the aircraft to be flown out.

The trouble with the engine was apparently just loading due to prolonged idling and rapid application of power. This is very common but usually it happens at an altitude that gives the pilot a chance to bring up the power a little more slowly. This instructor was probably a little lax, and his example is not recommended, but there undoubtedly is a student who won't forget to clear his engine when he gets up alone.

DURING A RECENT T-33 defueling operation, the shutoff valve on the defueler failed to close. Investigation revealed that the inlet line to the defueler contained four bolts, seven spring clips for retaining safety chains on fuel caps, two washers and two gaskets. All parts were identified as being common to the T-33.

The aircraft was being defueled because of an internal failure of the fuselage tank boost pump. Pilots who had last flown the aircraft had experienced malfunction of the low level warning light. The fuselage tank of the aircraft had been repaired within the last five months. Therefore, it is reasonable to assume that this debris represented a collection which was acquired within a five-month period. Refueling personnel reported that strainers on the refueling vehicle are inspected every 90 days. Regardless of whether debris came from one aircraft or from several, fuselage tanks should be carefully inspected for the presence of foreign objects which could result in malfunction or damage to the fuel system.

Robert B. Shanks
Directorate of Aerospace Safety

EXPLOSIVES ACCIDENT PREVENTION. There are so many management tools available pertaining to explosives accident prevention that some technicians engaged in munitions activities probably think that "Safety" with regard to explosives within the Air Force is being stressed too greatly.

Since munitions functions compare favorably with other activities in the overall explosives accident prevention program, why is explosives safety emphasized so much in the munitions career field?

The obvious answer is that when you work with munitions, you are handling items which are designed to kill people. An accident involving munitions could very possibly result in fatalities, serious injury, loss of strategic materials and property, and could conceivably bring about a combat mission failure.

Compliance with a suitable organizational explosives accident prevention program is your life insurance. Aggressive support of such a program by all individuals concerned, from the Commander down to the lowest working level troops, will greatly contribute to successful accomplishment of the organizational mission and will result in reducing and finally eliminating explosives accidents. Explosives safety is considered even more important in combat areas because of the adverse effect which explosives accidents could have on the combat mission.

Irving Hendler
OOAMA, Hill AFB, Utah

ABOUT 15 MINUTES AFTER TAKEOFF the pilot of an F-102 was notified that he may have blown a tire on liftoff. After burning off excess fuel, the pilot made a successful approach end arrestment following Dash One procedures.

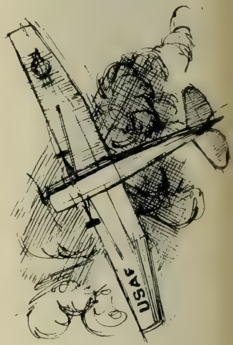
There was nothing very spectacular about this incident, a straight-in approach was made with touchdown 500 feet ahead of the BAK-9 barrier with drag chute out and nose down prior to engagement. But it does bring to mind a couple of items that pilots should bear in mind when using the hook for a brake: Shoulder harness should be locked, and the pilot should remove his hand from the throttle since the deceleration could, and did in this instance, cause throttle movement to 100 per cent.

AERO BITS

DURING LANDING an O-1 was caught in severe turbulence caused by vortices produced by a helicopter also approaching for a landing. The result was a badly damaged airplane.

The subject of vortices in the wake of aircraft has received a great deal of attention during recent months. Early this years the FAA sent probably every pilot, from student to ATR, a booklet titled *Wake Turbulence.* Primary attention has focused on the fixed wing aircraft and the generation of wing tip vortices. But the helicopter also generates vortices and these trail along behind the chopper just as do those produced by fixed wing aircraft. This is well illustrated in a film, Wake Turbulence, produced by the FAA and available for the writing. We've seen the film and think it is very good. To procure a copy, write to

FAA Film Library
Aeronautical Center
P.O. Box 25082
Oklahoma City, Okla. 73125.



WOULD YOU BELIEVE IT? A sergeant and an airman who were sent to change the fuel control on an engine had some trouble removing the inlet temperature probe so the sergeant reached into the intake and began tapping the probe with a mallet. The probe still failed to come out so he went after a larger hammer. Meanwhile, the airman got the probe loose and informed the sergeant, who forgot he had left the mallet in the intake.

Of course, the inevitable happened. The sergeant got into the cockpit to check the engine with the airman standing outside on the ground cord. The engine was started and then flamed out. Another start. But the engine wouldn't go past idle. The airman checked the throttle linkage and the sergeant moved the throttle several times. The engine then began to accelerate, but at approximately 2.0 EPR there was a violent surge so the engine was shut down. The wooden handle of the mallet had been ingested but the head, badly chipped was ejected. Some of the chips, however, went through the engine along with the wooden handle causing damage to compressor and turbine wheel blades.

TAXIDENT—A U-10 was being taxied to the wash rack about 3500 feet away. Noticing that there were no aircraft on the parking ramp the crew chief doing the taxiing left the taxi lane to cut across the ramp directly to the wash rack. Suddenly there was a metallic sound and vibration. The crew chief stopped the aircraft, shut down the engine and investigated. What he found was a slightly damaged fire extinguisher and some bent prop blades—the price of someone's leaving the extinguisher parked on the ramp and deviation from the designated taxi area. ★

U. S. GOVERNMENT PRINTING OFFICE 1966 251-210/2

WELL DONE

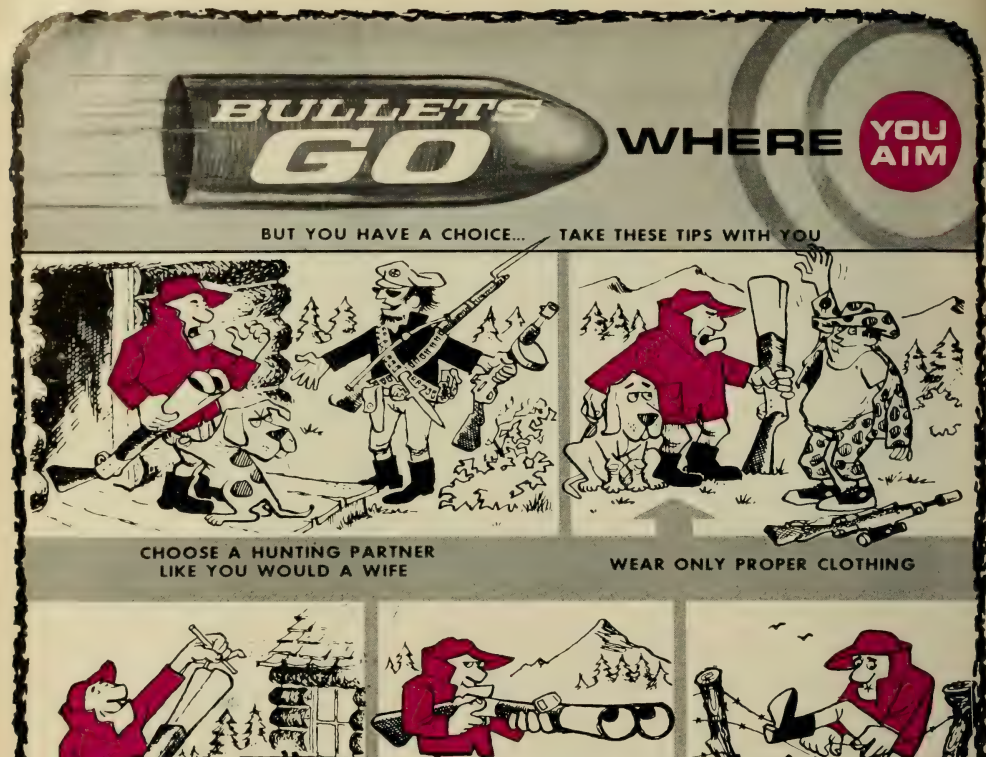
CAPTAIN ZACK D. PRYSE

29 FIGHTER INTERCEPTOR SQUADRON, MALMSTROM AFB, MONTANA

On 22 August 1965, Captain Zack D. Pryse prepared for a flight from Malmstrom AFB, Montana, to Perrin AFB, Texas, in a T-33 aircraft. The start, taxi and takeoff of Runway 20 were normal, but as the aircraft passed over the end of the runway a severe vibration was felt. The engine RPM was decreasing rapidly and the airspeed began to decrease from 160 knots. Captain Pryse immediately energized the gangstart switch and informed the observer in the rear seat of the situation and the possibility of an ejection. The emergency fuel control caught and was holding at 94 per cent rpm with 150 knots airspeed. The tower was notified of the emergency and that an immediate landing would be attempted. After delaying momentarily to assure that the heavily traveled highway a few hundred yards off the end of the runway was clear, the tips were jettisoned in an open field, and a turn back to Runway 02 for a downwind landing was started. During the turn it became apparent that he would be very close to the end of the runway, so Captain Pryse elected to attempt a landing from an SFO low key position on Runway 20. The vibration increased steadily, and the oil pressure started to fluctuate. At low key, a shallow turn was made to final, the gear was lowered, and a successful landing was accomplished on Runway 20.

Failure of a turbine blade had started the chain of events. The failed blade had broken pieces off more than half of the remaining blades and damaged all the turbine stator blades. Holes were punched in the shroud ring, exhaust cone, and tail pipe. Even though the rpm was 94 per cent, the thrust was probably much less than normal. This engine had only two previous flights since complete overhaul.

By his outstanding ability to properly evaluate and cope with a serious inflight emergency, Captain Pryse saved an aircraft and avoided an incident which could have caused injury or property damage. ★


BULLETS GO WHERE YOU AIM
BUT YOU HAVE A CHOICE... TAKE THESE TIPS WITH YOU
DEMPSEY
HAVE YOU SEEN AIR FORCE MOVIE GUN MAYHEM SFP-1257 ?

CHOOSE A HUNTING PARTNER LIKE YOU WOULD A WIFE

WEAR ONLY PROPER CLOTHING

UNLOAD, BEFORE YOU CLEAN

REGARD YOUR GUN AS ALWAYS LOADED

PUT YOUR GUN ACROSS THE FENCE FIRST

LET OTHERS KNOW WHERE YOU HUNT

SHOOT ONLY WHEN SURE OF YOUR TARGET

ENJOY THE GREAT OUTDOORS

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AEROSPACE

SAFETY

UNITED STATES AIR FORCE

DECEMBER 1966

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AEROSPACE SAFETY

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AFRP 62-1 VOLUME 22 NUMBER 12

FALLOUT

AVAST, YE NON-VOLUNTEERS

In Major Sherrill's article "Avast, Ye Swabs, We've Been Torpedoed!" (Oct. pg 10), the goof on the part of the U-11 is quite apparent. The book says VFR flight below 18,000 msl will be odd thousands plus 500 feet in the 0-degree to 179-degree M quadrant. Assuming the U-11 to be on the 137-degree radial outbound after completing the SID, then he should have been at 3500 or 5500 feet, etc., not 4500.

As an air traffic controller of some 20 years standing and a VFR (CFR) light plane pilot 'way back before WW II, this was easy to spot. However, not being on flying status I must decline your kind offer to go to SEA in the 0-1 program. Sorry about that!

Seriously, AEROSPACE SAFETY is one of the best professional "trade" journals I have ever read. Keep up the good work.

Maj Robert H. Tefft
Commander, 2191 Comm Sq (AFCS)
Dow AFB, Maine

Regarding the midair collision article, I wish to accept the challenge in purporting the U-11's goof. I believe Rex is referring to the U-11's altitude preceding and at the time of the accident. Deducting from the article an approximate easterly heading for the U-11, I would say that in lieu of his VFR clearance he was flying at an incorrect altitude if the terrain was not higher than 1500 feet msl. In this event, his altitude should have been an odd altitude plus 500 feet for an easterly heading between 0-179 degrees.

If this is the answer that you are looking for I'll appreciate a recommendation to fly 0-1's. In any event, we look forward to receiving and reading your excellent articles every month.

SSgt Jonathan C. Kuntz III
Shaw AFB, S. C.

The U-11 should have leveled at an odd plus 5 altitude and should have had radio contact with departure control if he was intent on using a standard IFR departure route. (The latter from common sense.)

Thank you, No, on SEA—and besides, who wants to be known as a VFR pilot?

Anonymous

I've just finished reading the article on pages 10 and 11 of the October issue of AEROSPACE

continued on page twenty-five

THE COVER

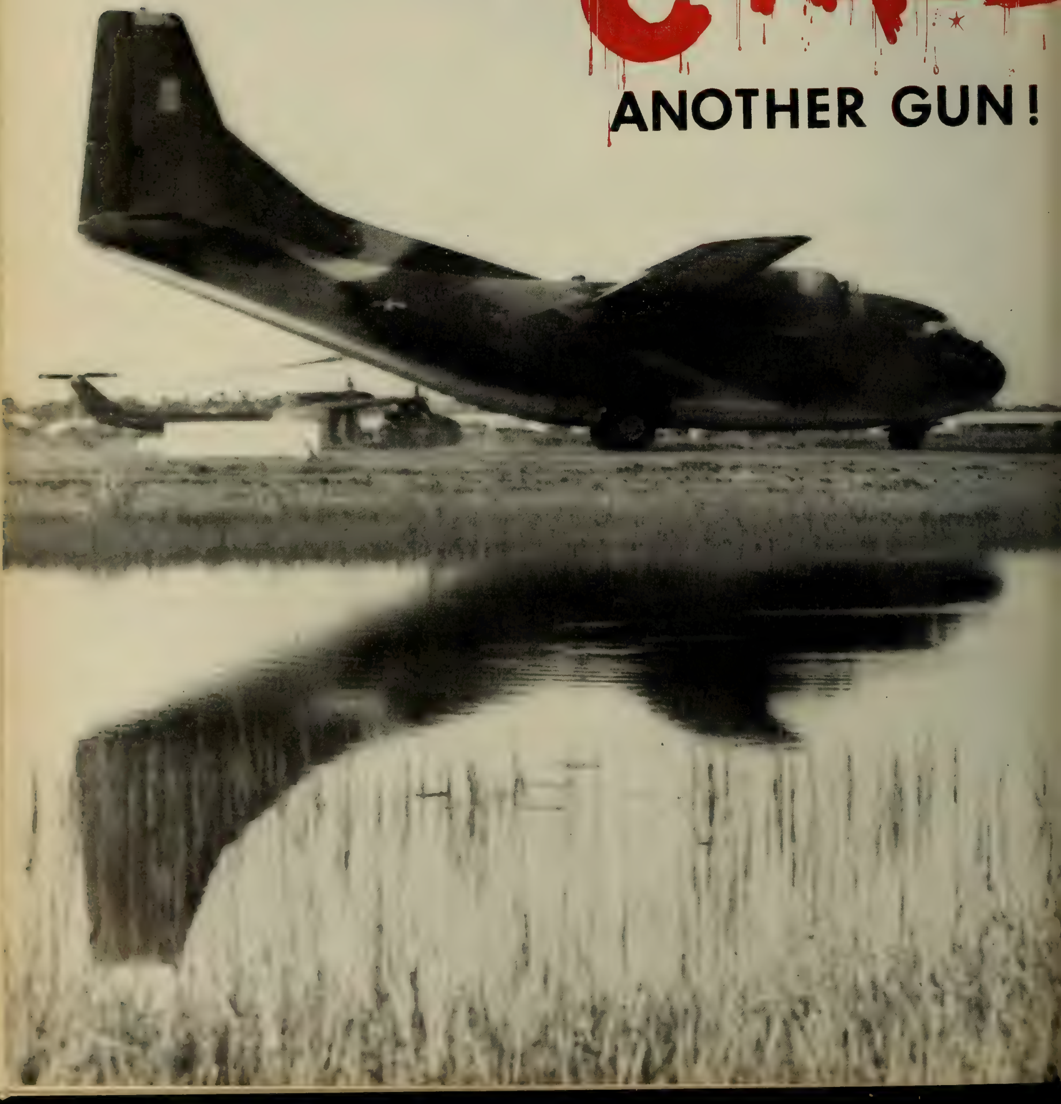
Credit for our cover drawing goes to Artist Dave Baer who got the idea from a well known drawing by Lt Col Thomas P. Garvin, TACLO to Army Combat Development Center, Ft Belvoir, Va. Lt Col Garvin did the original of a pilot loaded with gear while editor of USAFE's AIRSCOOP magazine.

SEAsons Greetings

SEAsons greetings from the members of the Directorate of Aerospace Safety. It is most appropriate that we emphasize the SEA of this holiday season because, although the intensity of the struggle in Southeast Asia may vary with the seasons, the continuing support of every member of the Air Force team is vital to free world survival. We invite you to continue to read and contribute to this publication for several good reasons. It's your magazine and, therefore, your interest is absolutely essential; also, it transmits the wisdom generated by the experiences of our fellow team members. Support the *big mission* by keeping *safety* in focus as a very important mission support factor. SEAsons Greetings.

The author recently returned from a one-year tour in Vietnam. He draws on his experience there as a C-123 AC and squadron Flying Safety Officer to present a hard-hitting argument against the idea that good safety practices can be disregarded in a combat environment.

DON'T GIVE CHARLIE ANOTHER GUN!



Capt Anthony J. Burshnick, 40 Mil Airlift Squadron, McGuire AFB, New Jersey 08641

We have often heard it said that Flying Safety is great, but when it comes to combat we can disregard it. Unfortunately, people *believe* that. Well, it just isn't so. True, we put mission accomplishment first, but aggressive flying safety is the best guarantee that the mission will be performed with maximum results.

Flying C-123s in Vietnam is a tough, demanding job. It takes training, skill, and a lot of luck to put a max grossed *Provider* safely down on an 1800 foot dirt strip. Equal ability and good fortune are required to thread your way through fog enshrouded valleys to a Special Forces camp carved out of the VC infested jungle. Skill and ability are acquired and innate traits, but Lady Luck? You have to be nice to her and when she starts holding out on you, you have to make your own luck. The best way to make it is to adhere to sound and proven operating procedures.

Let me cite a few cases where Flying Safety was compromised but Lady Luck stayed with our fortunate Air Commandos.

The pilots were in a big hurry to get off one more mission before darkness and weather closed down operations. The copilot started the right engine on the right mag. His failure to go to BOTH was probably due to some distraction during start. No sweat though, he would probably catch it during the mag check. As the aircraft approached the active, he requested an immediate takeoff from an intersection 1000 feet down from the start of the 3000-foot runway. Tower cleared him for an immediate, so "forget the checklist, everything looks good." Great, under normal circumstances, except that the right engine is running on one mag and the copilot had not set the water injection. Away they go. Power doesn't check! Not enough runway left to abort! "Our Father who art—Hey, it's flying! I think we will make it." They did, with Lady Luck for a copilot.

Then there was the pilot who was going to make an assault landing on an 1800-foot dirt strip with a cargo load of JP-4. Needless to say, stopping distance was critical so he planned on setting down right on the edge of the runway. Five feet from the approach end is a four-foot drop-off. On final everything looked good, but our pilot was getting nervous and pulled off too much power. Down came the *Provider* about five feet short of the drop-off. The first bounce was a good one—the aircraft landed up on the lip of the runway. Roll out was normal.

Well, like they say, it's a good landing if you can walk away from it.

The crew had just loaded up with 10,000 pounds of ammo and were taxiing out for takeoff when they heard a popping noise in the nose gear wheel well. Nose wheel steering was lost so the pilot assumed that the steering cable had snapped. He was going into an assault strip, but figured he could handle the aircraft without nose wheel steering. (This is not a recommended procedure.) He did not check to see exactly what broke but called for immediate takeoff. "Cleared" and off he went. When he called for gear up, the nose gear would not retract. He was able to get it locked down and requested a return to Tan Son Nhut. Landing and rollout on the 10,000-foot concrete runway was uneventful. Investigation showed that the nose wheel steering cable had snapped. Then it wrapped itself around the retract mechanism which prevented the nose gear from going up and locking. "Lady Luck rides again."

Well, let's let the "Lady" take one more ride and then get off. The pilot was either sweating out stopping on a 3500-foot runway, or else he thought inflight engine reversal would compensate for his excessive final approach speed. Anyway, about 10 feet in the air over a grassy overrun, he reversed. In the next five seconds he lost his 10 feet, his high airspeed, his composure, and about five years of the copilot's life. The landing was hard, but again no damage to anything but the pilot's pride.

So here we have some obvious violations of good operative procedures and a resulting compromise of safety—the fact that an accident did not result is either luck or Divine Providence.

Well, how about a ride with Luckless Larry. We will start out on final approach at the same assault strip that our short lander bounced one in on. Everything looks good and again he is shooting for the end of the runway. Pull a little power off, oops too much, and down comes the *Provider.* The bounce – right gear moves up through the wheelwell – the airaircraft swerves – hits a dirt pile – off the runway – through the boondocks – CLASS 26!! No injuries.

Let's go back out on final but on a different runway. The pilot finds himself a little low but is slow adding power. It looks like another short landing. The only trouble is that you don't land short on *this* runway. There are drop-offs on both ends and no overruns. More power, but too little too late! The nose gear hits the lip, then the mains do likewise, and our pilot makes a beautiful belly landing. In both cases the runways were the most difficult assault strips in Vietnam. They are 1800 to 2000 feet long. Surface conditions have to be guesstimated by the pilot and, of course, there is the constant threat of enemy fire. However, the computed stopping distance, in both cases, was approximately 1500 feet so there was really no need to put it on the end. It's the same old story, land a hundred feet long but not one foot short.

The next flight is with our reversing friend SANS Lady Luck. The crosswind at the assault strip is guessed to be at or near maximum. Parked helicopters line the rollout end of the runway, giving about three feet clearance on each wingtip. The Old Head is in the right seat with a "new to SEA" pilot in the left seat. The touchdown is a bit firm and they are airborne again. "Reverse inflight," only this time the nosewheel comes down first and collapses. The aircraft swerves off the runway and skids to a stop just short of the choppers. No injuries. Well, maybe Lady Luck was back in the cargo compartment.

Our next pilot has a snapped nose wheel steering cable but he doesn't know it. No rules were broken by this aircrew, but this episode shows what could happen if you elect to fly a questionable aircraft as our other pilot did.

The pilot briefed for the assault landing. He touched down in the center of the runway on his planned touchdown point. The aircraft rolled straight and full reverse was applied. The aircraft started to veer to the right so nose wheel steering and left brake were applied but with no effect. The right gear went off the runway and started knocking out runway markers. The right engine was brought out of reverse and into full forward range. The aircraft was finally stopped back on the runway with the nose gear cocked off 15 degrees to the right.

A quick look showed that the nose wheel steering cable had broken. Further investigation showed that the cable had been frayed and numerous strands were broken, long before this particular landing. Aircraft damage was just short of a minor accident.

There you have it: one aircraft destroyed and three badly damaged. The score could have been higher!

You must have some calculated risks in a combat situation. For example, every max gross takeoff from an assault strip. Lift-off speed for the C-123 runs about 95 knots and minimum single engine speed is 109 knots. When you lose an engine on takeoff, it's crash straight ahead. That was proven. However, you don't throw the book out the window because of these rare instances. In fact, proven operating procedures must take an even bigger role to minimize the risk that must be taken. Every time we damage an airplane we lose airlift when we can least afford to. The enemy takes his toll on our aircraft. Sloppy procedures that lead to accidents is just like giving old Charlie another gun. ★

THE IPIS APPROACH

By the USAF Instrument Pilot Instructor School, (ATC)) Randolph AFB, Texas

Here's an index to all IPIS Approach items that have appeared in AEROSPACE SAFETY since inception of this feature in January 1965—A CHRISTMAS GIFT for you from IPIS and AEROSPACE SAFETY.

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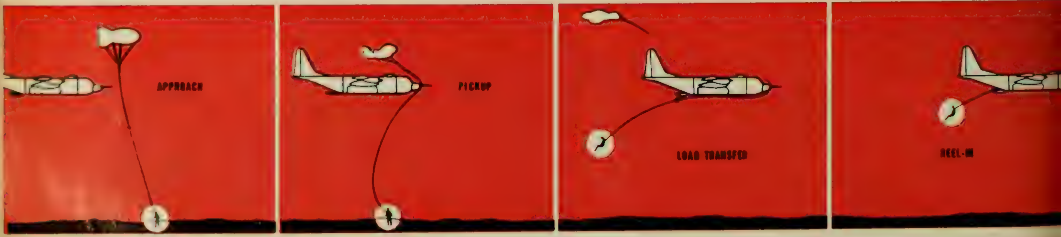
Copies of all IPIS Approach articles to date are available from the USAF IPIS, Randolph AFB, Texas 78148. ★

NEW SYSTEM PROVED FOR.. ARCTIC

THE FULTON RECOVERY TECHNIQUE



RESCUE

Capt James R. Stine, ASD, Wright-Patterson AFB

The pilot sitting in the life raft looks expectantly upward as the search aircraft flies over. Minutes later he is snatched from the sea and finds himself dangling at the end of a thin nylon line several hundred feet in the air.

Is this any way to run a rescue? You bet it is.

But how about the man down in the frozen Alaskan interior? He could freeze ice cubes in his pockets and needs help quickly. Will this same new rescue system work for him? On a bleak, chilly morning last winter, 15 men took off from Wright-Patterson AFB to find out.

This team – from the Deputy for Flight Test, Aeronautical Systems Division – arrived 10 hours later aboard an HC-130H at Eielson AFB, Alaska, 26 miles from Fairbanks. Their assignment: test and evaluate the Fulton recovery system installed on an updated version of the Lockheed C-130.

The Eielson area was selected for the test site as being one of the consistently coldest locations available. The temperature upon arrival was –28°F and a two-foot snow covered most of the open areas. The runway and taxiways were snow covered with a hard-packed layer. These weather conditions prevailed during the 21 days of the test, providing an excellent cold weather test environment.

The test force was greeted by the advanced party consisting of two men: one supply and one maintenance specialist, who had been deployed a week ahead of the main group to set up the offices, spare parts, and equipment storage in a nose dock hangar. The aircraft was parked in an open area adjacent to the hangar to obtain maximum exposure to the arctic environment.

The HC-130H testing was divided into three phases:

- Navigation and avionic equipment evaluation at high latitude and in cold environments.
- General aircraft operation evaluation in cold climates.
- Recovery equipment evaluation both during ground set up and during aerial pickup of dummy loads.

The navigation and avionic equipment tests encompassed three missions to evaluate the ASN-35A doppler navigation computers, two missions testing the Loran C and one polar flight to check the limits of operation for both systems.

The general aircraft system tests were performed in conjunction with the above missions and in two instances aerial recovery tests were also completed following avionics missions. The ground portion of the recovery presented some unique problems. The recovery test site was located six miles from the main base at Eielson on a former bomb range. Access roads to the ground site had been plowed open for access to automobile travel. However, to provide access across the open field, a trackmaster vehicle, similar to a weasel, and driver were borrowed from the Arctic Survival School. The snow cover was 20 to 24 inches deep and was difficult to traverse on foot. The trackmaster vehicle was large enough to carry 10 people, but it was used mostly to transport extra equipment to the ground site. The trackmaster drivers were arctic survival school instructors who also became the test subjects for the ground station set up. They were thoroughly experienced in arctic survival techniques, but had not seen the Fulton Recovery kit before this test. Neither man experienced much difficulty in following the kit set-up instructions and their arctic experience enabled them to give objective evaluation on the adequacy of the equipment for arctic use. The rescue kit comes in one or two man modules and day or night models.

The recovery tests followed a similar pattern for each mission. The aircraft would perform a simulated search using direction finding and tracking equipment to locate a portable ground transmitter activated by the ground crew. After homing in on the ground site, a pass at low level was made to drop the recovery equipment from the rear of the airplane. The ground

lated balloon will carry lift line ft for engagement by yoke on nose aircraft. Sequence is shown in wings at left.

Dummy attached to lift line begins journey aloft, reaches aircraft ramp in photo at right.

Arctic cold provided realistic environment for determining how recovery system will function under such conditions.

station set-up portion of the test was then begun using test subjects to assemble the parts of the kit. The kits were dropped in two parts; one container carrying the accessories and the other containing helium used to inflate a balloon. The accessories in the kit include a recovery suit-harness, 500 feet of braided nylon lift line and a large plastic balloon resembling a small dirigible used to hold the lift line vertically. The problems facing the man to be rescued are to gather the equipment, dress in the suit, and inflate the balloon after attaching all lines properly. These tasks were aggravated in the arctic by the cold and the snow and complicated by the bulky arctic clothing worn by the test personnel. The recovery suit and balloon were stiffened by the extreme cold temperatures encountered down to –35°F during the tests. The arctic clothing also made dressing difficult and brought on extreme perspiration if the individual tried to work too rapidly.

After the man is dressed in the suit and has attached the lines between the suit and balloon, the balloon is ready for inflation. The helium used for inflation is held under 4000 psi pressure in fiberglass bottles. The bottles are too heavy for one man to move, especially through deep snow; therefore, the balloon and other equipment has to be carried to where the helium containers landed. After inflation is complete, the balloon is released to rise and pull the lift line up to maximum extension in readiness for the aerial recovery.

In Alaska, dummies were used for the recovery since the initial live pickups had not yet been made. (Since the Alaskan test, successful live recoveries have been made at Edwards AFB.) The dummies were carried to the pick-up site aboard the trackmaster vehicle and attached to the lower end of the lift line just before the aerial recovery portion of the test.

The aircraft approaches the lift line at about 450 feet altitude and 125-130 knots. This is 125 feet beneath the balloon. Upon contacting the line with the V-shaped yoke on the C-130's nose, the balloon breaks free at a weak link and floats away.

The line is locked into the nose of the aircraft and trails underneath the fuselage aft where on the open ramp, the recovery crew stands ready to snag the line and retrieve it into the rear. The crew at the rear secure the line which is then released from the nose. The front end of the line is then drawn into the rear and attached to a hydraulic winch, at which time the other ties are released and the man reeled in. (For a more detailed description of the system, see AEROSPACE SAFETY for July, 1965.)

In arctic temperatures the recovery crew had to wear full arctic clothing plus a face mask to prevent frostbite from the wind blast received at the end of the open ramp.

The recovery pick up, when viewed from the ground, gives the appearance of lifting the subject smoothly almost vertically for some 50 feet as the nylon stretches, absorbing most of the shock of the contact by the aircraft, 450 feet above. A face mask for the recovered man would also be mandatory in addition to the suit to protect him from the extreme wind chill during his aerial flight attached to a line behind the airplane. From line engagement by the airplane until the dummies were boarded took an average of six minutes.

A series of the aerial pick-ups was performed, both single man and dual, to evaluate all possible contingencies of arctic recoveries before the tests were considered complete. The low temperature remained constant throughout a three-week period and the tests were completed in record time. The HC-130H aircraft and Fulton Recovery gear did not exhibit any serious deficiencies under arctic operation.

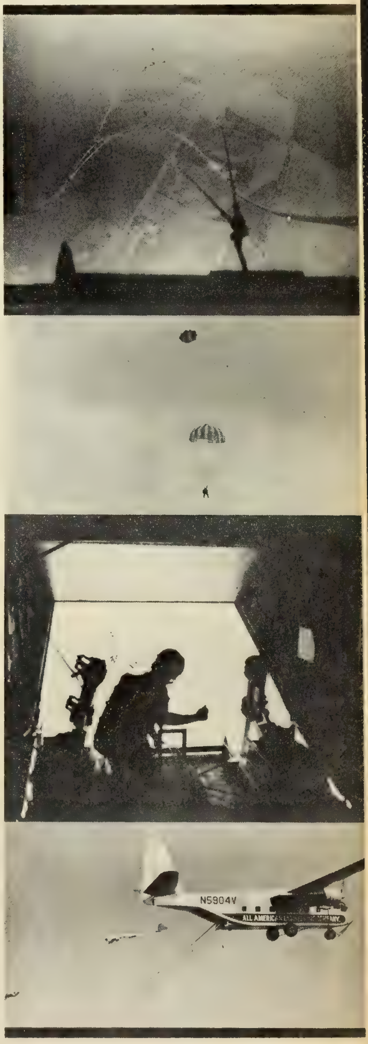
The Air Force now has one more effective tool for recovery of downed airmen and is currently equipping Air Recovery Squadrons throughout the world with the HC-130 aircraft. ★

Midair Retrieval

While the HC-130H is in the business of picking up survivors from the ground, a group of experimenters in Delaware snatched a parachutist in midair. The purpose of the exercise conducted by All American Engineering Co. and Pioneer Parachute Co. was to demonstrate a means of preventing pilots who bail out of disabled aircraft from falling into enemy hands. The photos, top to bottom, show:

- *Engagement assembly of the aerial recovery system,*
- *Engineer Chuck Alexander of Pioneer ready for recovery,*
- *Successful engagement,*
- *Alexander approaching the ramp of All American C-122.*

The basic equipment used has existed for several years and has been used for recovery of a variety of payloads since the mid fifties. The parachute system is a standard 28-foot main chute with a reinforced 11-foot diameter target or engagement chute above the main canopy. The loads on Alexander were reported to be six "G" maximum — less than those during opening shock of the parachute. ★



as ye SOW

Capt George H. Holbrook
35 Tac Ftr Wg, Danang AB, Vietnam

During a recent flight line inspection, I came across two helicopters that hadn't been grounded. As I stopped and took note of the situation, the sergeant in charge became aware of my presence and sauntered over. I didn't have to glance at the numerous stripes on his arm to know he was in the "Super Sergeant" category. His thinning crop of grey hair and his weather-worn countenance marked him as an old timer in the Air Force.

After a few courteous remarks had been passed, I got down to my reason for stopping. I asked the old Sarge why the choppers weren't grounded.

"Sorry, Captain," he replied, "I just didn't tell the boys to ground them. We just got here and, well, last year when I was at this base, there weren't any safety people and we were pretty much on our own."

After pausing a moment to digest this extraordinary bit of information, I reminded the sergeant that safety people were now stationed at this base and that aircraft would be grounded. His reply stunned me into shocked silence, momentarily. With all sincerity he said, "Yes sir, we'll ground them from now on. By the way, Captain, since I'm new on the base, I don't know how you operate. What do you want me to do here?"

After a few seconds, I shook off my surprise and stammered, "Do your job, Sarge, and do it right just as you have been trained to do it."

He sort of nodded his head "yes" and went back to his aircraft. I left after making sure the birds were grounded.

Later, as I sat melting away in the oven, facetiously titled "Office," I thought back to this conversation and became irritated. The request for instructions on what I wanted *him* to do annoyed me. I couldn't believe that a sergeant with over 20 years service and with more stripes on his arm than a computer can count didn't know his job and had to ask for guidance. Upon further reflection I finally concluded that the old Sarge just hadn't realized that when he does his job as he has been trained to do, using checklists, SOPs, etc., he is doing the job safely. That led me to wondering how many other troops, especially those with fewer years in service, had failed to realize that adherence to regs, checklists and the like goes hand-in-hand with safety. Do you belong to this unfortunate group?

But the part of the conversation that irritated me the most was the Sergeant's operations a year ago. No safety people were here then so he and his men were pretty much on their own. From his statement it is easy to conclude that safety wasn't even considered. Does it take the presence of safety personnel peering over your shoulder and watching your every move to make you do the job correctly? If it does, then, brother, you are in sad shape. Pride in your work should make you want to do the job properly. Your intelligence should tell you that rules, checklists and other controls have been established to help you do the job correctly achieving maximum results with minimum risks.

If you need close supervision at every step of the way to make you toe the mark, then the Air Force doesn't want you. It can't afford you. No business—and the Air Force is big business—can afford to have one supervisor watching you all day long. The alternatives then are to let you work without supervision—and cause a catastrophe—or replace you with a *trustworthy* individual. A smart business would do the latter.

This lack of pride in one's work, this unwillingness to discipline one's self and do the job properly is a poor and dangerous attitude. It is particularly dangerous to the Air Force's efforts in Vietnam because it quite often hides under the name of *war zone-itis.* "We are here to fight a war," so the argument goes, "so there is no time for this safety jazz. We have to get the job done."

I'll be the first to admit that this is a war zone and that we must get the job done. But I'll also be the first to disagree that supervisory controls and safety practices must be relaxed or eliminated. The Air Force has been in the business of fighting wars for over 50 years now and has learned from bitter experience—several times over, in fact—that supervisory controls and safety practices are the only sure means of "getting the job done." For example, in World War II we lost more aircraft in training accidents than to enemy action. During the Korean struggle the Air Force switched to the untamed tiger attitude among its new pilots and promptly littered the countryside with mangled pieces of aluminum.

Even here in Vietnam we have had a bitter lesson. How many of you who say that we must get the job done have ever seen the *complete job* done on Bien Hoa? The toll of death and destruction from that catastrophe was enormous. Is safety to be ignored in operations (get that job done) until the bill for our neglect is rendered and the full price in precious lives and expensive equipment must be paid? Will it be then, and only then, that the light will be seen and safety sought as an important adjunct in our operations?

Will there be another disaster before we learn our lesson? I don't know. The answer lies with every man on the flight line, in the bomb dump, in operations and in maintenance. If you do your job and faithfully follow all procedures and checklists, then the answer will be *no.* If you want to do the job your way using your own homemade, unapproved procedures (and the h.... with safety), then let me know where you work. I don't want to be there when it all goes B-O-O-M! ★

SOMETIMES THE AIRPLANE WON'T FORGIVE YOU

The light airplane, like the automobile, is relatively a safe machine and will forgive many errors. If this were not so, the countryside would be littered with aircraft remains. Nevertheless, this type of flying extracts a grim toll of life and limb.

No, we're not working our way into an aero club story. The subject here is Air Force personnel and light aircraft either privately owned or rented from an operator. (No aero club accidents are included.) Accidents in these aircraft have cost the Air Force 25 lives from Jan 1965 through Sept 1966, a toll that is all out of proportion to risks involved in this type of flying. The reasons for this unhappy situation should be evident after a brief look at some of these accidents and their causes.

A sergeant was killed when his single engine aircraft crashed shortly after takeoff. While on a cross-country flight, he had arrived at the airport on the preceding afternoon and prepared to depart shortly after dark. However, he returned within a few minutes and RON'd. He was killed the following morning when he took off and crashed in the before-dawn darkness.

This man was considered by his instructor to be an average student but somewhat over-confident. He had no instrument training and very little night time during his 65 hours, 25 of which were solo. He had been briefed not to fly except during daylight hours.

The cause of this accident was that the pilot probably over-extended his capabilities by taking off at dawn toward a dark area in which there was no visible horizon.

A multiplicity of factors may explain why a young officer ended his career against a hillside in a small two-place aircraft. Although he was a rated navigator, he had only 20.3 hours of flying time and was working toward a private license.

During his second solo cross-country he flew from homebase to another airfield an hour and a half away. The crash occurred approximately one hour after takeoff on the return leg. Impact was at 2500 feet in weather reported as being 1500- to 1900-foot overcast with 10 miles visibility. A resident near the crash scene stated that the peaks were obscured by fog and haze. Another student made an emergency landing because of the weather.

The possible causes of this accident are several. Lack of experience with weather of the type that existed at the time was considered to be one factor. Contributing were anxiety because the pilot had duty the next day—this may have led to gethomeitis. Possibly he was over-confident due to his experience as a navigator in which he had participated in many IFR flights.

Many experienced military pilots have fallen victim to disorientation, so there is no reason to believe that inexperienced private pilots are immune to this phenomenon. Our third example concerns a captain who crashed during a night VFR cross-country. From takeoff at about 7 p.m. until 30 minutes before the crash, he apparently had no problems. Then he was heard on the radio saying he was uncertain of his position and that he was going to descend to see if he could spot some lights. Shortly after this, a man heard an aircraft fly low over his house and ran outside. He testified that he heard the engine go to full power then saw a ball of fire as the aircraft crashed.

Evidence at the scene indicated the right wing tip struck the ground first and the aircraft then cartwheeled. Weather at the time was indefinite 100-foot ceiling, obscuration, visibility one-half mile, variable in fog. This pilot with only a little over 100 hours total time and only 24 hours solo flying was a patsy for this kind of weather and did what you would expect an inexperienced pilot foolish enough to get into such a situation to do: he flew the aircraft into the ground.

While the type of accident illustrated by the above examples predominates, others brought about by different causes were just as avoidable. One young airman with 24 hours total time, including only four hours solo, landed and parked his aircraft. There was a 20 knot wind blowing (which probably should have precluded flying for a pilot of his experience) so he pulled the control stick back and buckled the safety belt in the right seat around the stick. Later, on takeoff the aircraft reached flying speed and went into a steep nose-high attitude. After climbing about 50 feet, it stalled, spun and crashed. What happened is obvious. Also clear is the fact that the pilot failed to perform a proper preflight.

Another airman with 38 hours total time, who hadn't flown for a month, flew into a mountainside in very poor visibility. Most probable cause: spatial disorientation in instrument weather.

A qualified pilot, while intoxicated, struck a tree at night about 75 feet above the ground and crashed.

It doesn't take much of an analyst to see that the major factors in these light aircraft accidents are lack of judgment compounded by inexperience. These are tough to combat. Recommendations included special meetings and safety material for light aircraft pilots, suggestions that they confine their flying to the aero club. These are certainly valid, but the burden of responsibility must be on the individual. One reason for printing this article and giving the several examples is to bring to the attention of those light aircraft pilots who haven't yet had a serious accident the fact that others of like experience and enthusiasm have bought the farm.

The examples cited should indicate to the man intelligent enough to learn to fly that motor skill will never replace judgment. The ability to coordinate stick and rudder is good but not unusual. Monkeys can coordinate hands and feet. But do they have the judgment to make a one-eighty when the weather ahead looks threatening?

The FAA recently announced that the general aviation accident record was the best in history in 1965. Let's keep it improving by

- Recognizing as well as possible our limitations and not exceeding them,
- Not substituting audacity for good judgment. ★

Rex Riley
CROSS COUNTRY NOTES

HAVING AN ACCIDENT IS NO ACCIDENT. Double-talk? Not at all.

Webster defines "accidental" as "happening by chance." In practically all instances, investigation of mishaps reveal that they happened by design. Each was caused by some overt act which the individual involved knowingly committed or a set of conditions which were knowingly generated.

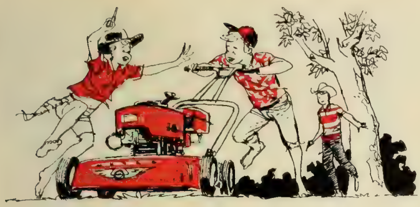
Simply stated, most accidents don't just happen, THEY ARE CAUSED either by an individual or a group of people who, although they should know better, commit the act or acts which result in the mishap.

For example, consider the sequence of events that led to injury or death to the individual and to damage or destruction of property in the following case studies.

Take the case where a group of airmen went out on the town one night, drinking to excess at several bars into the early morning hours. The driver, whose thinking becomes irrational under the influence of alcohol and who is fatigued, is spurred on by his cohorts and drives along winding country roads at speeds in excess of 100 mph. Yes, the result was a head-on collision after the driver lost control of the vehicle. Two vehicles were demolished, two people killed and several others seriously injured.

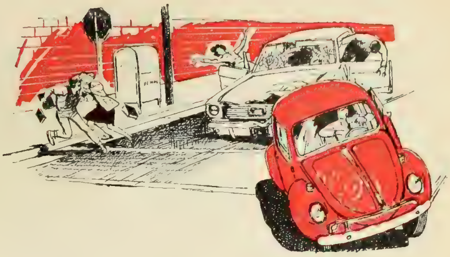
Was this an accident? Hardly, for the resultant mishap was inevitable. The individuals set the stage for this one. It's as simple as one and one makes two—mix drinking, fatigue, driving, speed and recklessness and the result, practically without exception, is DISASTER.

Or, consider the parent who tells his child to mow the front lawn with a power mower. The child, eager



to please, cranks up the motor and starts to cut the grass. Unfortunately, the parent didn't supervise the operation, or he would have seen that his child was barefoot, that the grass was slightly wet, that other children were around and the task became one big game. You see, the child didn't know any better, but—THE PARENT SHOULD HAVE. Yes, I'm sure you already know the result for it was inevitable. The child slipped and fell with his foot caught under the mower's blades. Cost: loss of the child's toes which were cut off by the power mower. This was hardly just a happening, it was no less than should have been expected—an act of negligence.

Or, review the events that occurred at another base during an aircraft maintenance operation. Contrary to tech order procedures, a maintenance team attempted to check gear retraction on one gear of a B-52 that was fully loaded with fuel. Oh yes, jacks would not be used, but they would secure the remaining gear with down-locks. Stupid you say? Doesn't make sense? Well, I agree, but facts are facts and in practically all instances of maintenance malpractice mishaps, similar stupid, nonsensical acts were committed. Where was the supervisor? Of course, he was directing the operation. You might say that he was the one that masterminded the whole "comedy" of errors. As you have probably gathered by now, the aircraft settled when the gear collapsed causing extensive damage. The down-lock had fallen out. Accident? Not by any stretch of the imagination. This mishap was caused, perpetrated and engineered by the personnel who committed unsafe, unauthorized acts.

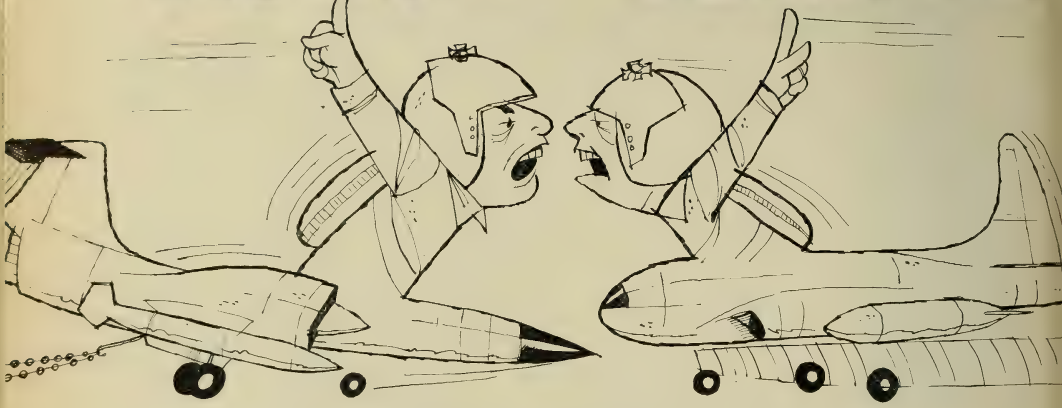


Lastly, I would be remiss in this account of people caused accidents if I did not highlight for you what I consider to be the most ridiculous seat belt mishap of the year. Can you imagine anyone not using seat belts after he had been in a prior auto accident and sustained injuries because he was *sitting* on the seat belts? Well, our records reveal just that. This individual, within a three-month period was involved in *two* vehicle accidents in which he sustained injuries which could have been prevented had he used the seat belts. Some people just never learn.

In closing I should like to point out that the above examples are not isolated cases. Rather, the acts of omission and commission that are ridiculous and unbelievable are continually being revealed in accident investigations. These acts are being committed by people who know better, by the very people who thought that only the other guy would have the accident—surely not themselves. With this in mind, I would like to set the record straight. Accidents *can* and *do* happen. They *can* and *will* happen to you if you cause them.

However, I know that you will not commit those foolish acts. I know that you will use and follow checklists. I know that you will use only published procedures. I know that you will exercise caution, moderation and common sense in all activities. I know that you will prevent accidents and I know that you will enjoy the good life throughout the coming year and all the years to come. Have a safe and sane Holiday Season, with our best wishes from everyone at Aerospace Safety. **(Contributed by Lt Col Murray Marks, Directorate of Aerospace Safety.)** ★

THE Hook vs. THE Barrier



Lt Col Richard R. DeLong, Directorate of Aerospace Safety

WOULD YOU BELIEVE . . .

- The BAK-9 is no longer being procured for USAF use and hasn't been since 1962?
- The BAK-12 is the current USAF standard arresting gear, is still being procured and over 100 units are in operation, as opposed to approximately 190 BAK-9 units? (As of 31 Aug 66.)
- The BAK-12 has a higher overall capability, but, in most aircraft, it must be engaged at a lesser speed than the BAK-9, at the same aircraft weight?
- The pilot handbooks do not contain recommended engagement speeds for the BAK-12?
- Some handbooks do not contain recommended BAK-9 engagement speeds for all aircraft weights, but only give a maximum or approximate maximum?
- The lighter the aircraft, at a given engagement speed, the higher the G loads? (The one exception is the F-4C when engaging the modified BAK-12. BAK-12 units in SEA are to be modified to upgrade compatibility with the F-4C aircraft.)
- Barrier engagement weight/speed limitations are of mixed origin? In some cases, the barrier is the limiting factor, in others it is the limit strength of the aircraft arresting hook.

Just where do we stand in this business of aircraft arresting gear, or *barriers* as they are most commonly called? Other than the operational procedures involved in preparation for and engaging a barrier, it is probable that the average pilot is not the world's greatest expert on the subject.

Let's discuss some of the "would you believe" statements above.

There are 190 BAK-9 units in the field. As they wear out and replacement parts are depleted, we will have to reinitiate BAK-9 procurement or replace BAK-9 units with the BAK-12.

In the meantime, all new installations are BAK-12. During the period April through August 1966, BAK-12 units in the field increased by approxmiately 50 per cent.

The BAK-12, in simple terms, is a beefier system than the BAK-9 and has a higher energy absorption capability. With the same nominal runout of 950 feet, the increase in capability also causes slightly higher aircraft hookloads. Accordingly, the maximum allowable engagement speeds for the F-101, F-102, F-104, F-105 and F-106 are somewhat reduced when engaging the BAK-12 from those allowed for the BAK-9 (see appropriate aircraft charts). The F-100 and F-4C maximums increase for the BAK-12, due, in both cases, to higher strength of the aircraft tailhook.

Discounting the limiting factor of aircraft tailhook

FIG. 1

	BAK-9	BAK-12
Installation	Fixed	Optional (Nomally Portable)
Energy Absorption Capability	55 Million foot-pounds	65 Million foot-pounds
Nominal Runout	950'	950'
Tape Strength (Ultimate)	70,000 pounds	105,000 pounds
Cable Strength (Ultimate)	84,000 pounds	84,000 pounds
Max. Engagement Speed (Barrier Dynamic Limit)	190K	190K
Max. Allowable engagement weight at 190K	28,000 pounds	43,000 pounds

strengths, figure 1 shows BAK-9/BAK-12 comparisons:

The G load imposed on an aircraft during a barrier engagement is of some importance to a pilot. Perhaps you can get an idea of what to expect from the accompanying charts. Notice that these forces can run from 4.85 at the top of the F-104/BAK-12 column (Chart B) to .9 at the bottom of the F-105/BAK-12 and BAK-9 (Chart A). If you snatch the BAK-12 at 190K in a lightweight F-104, take our advice and lock your shoulder harness! The G loads are the result of the aircraft overcoming resistance offered by the barrier. The heavier the aircraft, at a given speed, the easier this resistance is overcome. Even though hookloads increase with aircraft weight (at a given speed), the increase is not comparable. For instance, on the BAK-9 at 160K engagement speed, a 20,000-pound aircraft experiences a 45,000-pound hookload. A 30,000-pound aircraft under the same conditions experiences a 52,000-pound hookload—a 50 per cent increase in aircraft weight and a 15 per cent increase in hookload.

We will not devote much time to the shortcomings of the pilot's handbooks. The charts that appear herein will be forwarded to the appropriate agencies and will be included in the handbooks at some future date.

Note that the engagement speed charts give speeds for two hook strengths, design and yield. To a pilot this means one thing: If you engage on the design strength chart, aircraft inspection in accordance with appropriate T.O.s is all that's necessary. However, if you exceeded the design hook strength, make sure the hook is replaced! At home base you shouldn't have to worry about this, but on a trip it may be helpful. In any case, if you exceed design hook strength, include this fact in your form 781 write-up.

Taking the barrier at yield hook strength limits is acceptable and, all things considered, is safe. By "safe" we mean: the hook won't break and the barrier won't break. By "all things considered" we mean: provided the barrier is properly maintained (including adjustments) and the aircraft hook has not been previously damaged.

There are numerous safety factors built into the aircraft/barrier systems. For instance, the BAK-9 limiting factor is a tape tension of 38,000 pounds; the ultimate tape strength at the sewed attachment loops is 54,000 pounds; the BAK-12 limiting factor is cable tension of 50,000 pounds; the ultimate cable strength is 84,000 pounds. As for aircraft tailhooks, the ultimate tensile strengths in pounds are: F-100, 126,000; F-101, 100,000; F-102, 70,500; F-104, 90,000; F-105, 75,000; F-106, 82,200 and F-4C, 247,000. A barrier engagement is an emergency procedure. If for some reason you find yourself in the position of engaging the barrier in excess of the Chart B limits for your aircraft, we suggest you do it! It sure beats ejecting on the runway, if that's the only alternative. Chances are, within ultimate tensile strength limits, that you'll walk away from it.

The charts on the following pages provide information which we feel has been needed for a long time. Speeds are based on extrapolated test data. Loads are given to the closest .05 G. If and when you have to use this information, remember what has been said about aircraft hook integrity *and* barrier maintenance. Without these—no guarantees and no refunds.

FIG. 2
F–100 MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A
DESIGN HOOK STRENGTH, 84,000 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
24,000	190K	3.0	190K	3.1
26,000	190K	2.85	190K	3.0
28,000	189K	2.7	190K	2.9
30,000	187K	2.55	190K	2.8
32,000	185K	2.35	188K	2.6
34,000	183K	2.25	187K	2.45
36,000	181K	2.1	186K	2.35
38,000	179K	2.0	185K	2.2
40,000	177K	1.9	183K	2.1
42,000	173K	1.8	179K	2.0

LIMITING FACTOR: Barrier, Both Charts.

CHART B
YIELD HOOK STRENGTH, 96,500 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
190K	3.0	190K	3.1
190K	2.85	190K	3.0
189K	2.7	190K	2.9
187K	2.55	190K	2.8
185K	2.35	190K	2.65
183K	2.25	190K	2.55
181K	2.1	190K	2.45
179K	2.0	190K	2.35
177K	1.9	190K	2.3
173K	1.8	190K	2.25

FIG. 3
F/RF–101 MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A
DESIGN HOOK STRENGTH 67,000 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
30,000	181K	2.25	173K	2.25
32,000	179K	2.1	171K	2.1
34,000	177K	1.95	170K	1.95
36,000	175K	1.85	168K	1.85
38,000	173K	1.75	166K	1.75
40,000	171K	1.65	165K	1.65
42,000	167K	1.6	161K	1.6
44,000	163K	1.5	157K	1.5
46,000	159K	1.45	153K	1.45
48,000	155K	1.4	149K	1.4
50,000	151K	1.35	145K	1.35
52,000	148K	1.3	141K	1.3

LIMITING FACTOR: Tailhook, Chart A; * Barrier, ** Tailhook

CHART B
YIELD HOOK STRENGTH 77,000 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
188K*	2.55	184K**	2.55
186K*	2.35	182K**	2.4
184K*	2.25	181K**	2.25
182K*	2.1	179K**	2.15
180K*	2.0	177K**	2.0
177K*	1.9	176K**	1.9
173K*	1.8	172K**	1.85
169K*	1.7	168K**	1.75
165K*	1.65	164K**	1.65
161K*	1.55	160K**	1.6
158K*	1.5	157K**	1.55
155K*	1.45	153K**	1.57

FIG. 4
F/TF–102 MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A
DESIGN HOOK STRENGTH 47,000 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
20,000	163K	2.35	155K	2.35
22,000	161K	2.15	153K	2.15
24,000	159K	1.95	151K	1.95
26,000	157K	1.8	149K	1.8
28,000	155K	1.65	147K	1.65
30,000	153K	1.55	144K	1.55
32,000	151K	1.45	141K	1.45

LIMITING FACTOR: Tailhook, Both Charts

CHART B
YIELD HOOK STRENGTH 54,000 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
174K	2.7	161K	2.7
172K	2.45	159K	2.45
170K	2.25	157K	2.25
168K	2.1	155K	2.1
166K	1.9	153K	1.9
164K	1.8	151K	1.8
162K	1.7	149K	1.7

FIG. 5
F–104 MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A
DESIGN HOOK STRENGTH 60,000 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
14,000	188K	4.3	181K	4.3
16,000	186K	3.75	179K	3.75
18,000	184K	3.35	177K	3.35
20,000	182K	3.0	175K	3.0
22,000	180K	2.7	173K	2.7
24,000	178K	2.5	171K	2.5
26,000	176K	2.3	169K	2.3
28,000	174K	2.15	167K	2.15

LIMITING FACTOR: Tailhook, Chart A; * Barrier; ** Tailhook

CHART B
YIELD HOOK STRENGTH 69,000 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
190K*	4.4	190K*	4.85
190K*	4.0	189K**	4.3
190K*	3.65	187K**	3.85
190K*	3.35	185K**	3.45
190K*	3.15	181K**	3.15
188K**	2.85	179K**	2.85
186K**	2.65	177K**	2.65
184K**	2.45	175K**	2.45

FIG. 6
F–105 MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A
DESIGN HOOK STRENGTH 50,000 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
28,000	159K	1.7	151K	1.7
30,000	157K	1.65	149K	1.65
32,000	155K	1.55	147K	1.55
34,000	153K	1.45	145K	1.45
36,000	152K	1.4	143K	1.4
38,000	151K	1.3	141K	1.3
40,000	149K	1.25	140K	1.25
42,000	145K	1.2	137K	1.2
44,000	141K	1.15	133K	1.15
46,000	138K	1.1	129K	1.1
48,000	133K	1.05	125K	1.05
50,000	129K	1.0	122K	1.0
52,000	125K	.95	118K	.95
54,000	122K	.9	115K	.9

LIMITING FACTOR: Tailhook, Both Charts

CHART B
YIELD HOOK STRENGTH 57,500 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
170K	2.05	162K	2.05
169K	1.9	161K	1.9
167K	1.8	159K	1.8
165K	1.7	157K	1.7
163K	1.6	155K	1.6
161K	1.5	153K	1.5
159K	1.45	152K	1.45
155K	1.35	148K	1.35
151K	1.3	144K	1.3
147K	1.25	140K	1.25
143K	1.2	136K	1.2
140K	1.15	132K	1.15
136K	1.1	129K	1.1
132K	1.05	125K	1.05

FIG. 7
F–106 MAXIMUM BARRIER ENGAGEMENT GROUND SPEED

CHART A
DESIGN HOOK STRENGTH 54,800 LBS.

Acft Weight	BAK-9	Acft G Load	BAK-12	Acft G Load
26,000	169K	2.1	161K	2.1
28,000	167K	1.9	159K	1.9
30,000	165K	1.8	157K	1.8
32,000	163K	1.7	155K	1.7
34,000	161K	1.6	153K	1.6
36,000	159K	1.5	151K	1.5
38,000	157K	1.4	149K	1.4
40,000	156K	1.35	148K	1.35
42,000	153K	1.3	144K	1.3

LIMITING FACTOR: Tailhook, Both Charts

CHART B
YIELD HOOK STRENGTH 63,000 LBS.

BAK-9	Acft G Load	BAK-12	Acft G Load
180K	2.4	173K	2.4
178K	2.25	171K	2.25
176K	2.1	169K	2.1
174K	1.95	167K	1.95
172K	1.85	165K	1.85
170K	1.75	163K	1.75
168K	1.65	161K	1.65
167K	1.55	160K	1.55
163K	1.5	156K	1.5

FIG. 8
F/RF–4C MAXIMUM BARRIER ENGAGEMENT GROUND SPEEDS

CHART A*
DESIGN HOOK STRENGTH 165,000 LBS.

Acft Weight	BAK-9	Acft G Load	Standard BAK-12 1" Pendant	Acft G Load	Modified BAK-12 1 1/8" Pendant	Acft G Load
30,000	188K	2.55	190K	2.8	190K	2.8
32,000	186K	2.35	190K	2.7	190K	2.7
34,000	184K	2.35	190K	2.6	190K	2.6
36,000	182K	2.1	190K	2.45	190K	2.45
38,000	180K	2.0	190K	2.35	190K	2.35
40,000	177K	1.9	190K	2.3	190K	2.3
42,000	173K	1.8	190K	2.3	190K	2.3
44,000	169K	1.7	188K	2.25	190K	2.35
46,000	165K	1.65	184K	2.15	190K	2.5
48,000	161K	1.55	180K	2.1	187K	2.6
50,000	158K	1.5	176K	2.0	185K	2.5
52,000	155K	1.45	172K	1.9	181K	2.4
54,000	151K	1.4	169K	1.85	178K	2.35
56,000	147K	1.35	165K	1.8	175K	2.25
58,000	143K	1.3	162K	1.7	172K	2.15

*NOTE: The F–4C is the only acft in USAF with a tailhook strong enough to accept the capabilities of all barrier systems. No Chart B is required as engagement speeds are the same as Chart A for all systems. All speeds barrier limited.

For those who may have occasion to tangle with the BAK-6, we've included a chart for you, too. Test plotted and extrapolated data are not as complete as that for the BAK-9 and BAK-12. However, if you will take the design or yield hook strength for any aircraft, you can determine the limits that apply. To further assist in this determination, the following is quoted from the BAK-6 test report:

"The BAK-6 in the standard 1500-foot runout configuration will arrest all present hook equipped fighter weight aircraft from 13,000 to 52,000 pounds. However, the design limit of the cables restricts the maximum on-center engagement speed to approximately 145 knots for a 52,000-pound aircraft and approximately 160 knots for all aircraft of 34,000 pounds or lighter."

With that and the aircraft hook strengths in mind, here's the BAK-6 information, figure 9.

FIG. 9

Acft Weight	Maximum Engagement Speed	Hookload
24,000	160K	45,000
26,000	160K	48,000
28,000	160K	51,000
30,000	160K	54,000
32,000	160K	57,000
34,000	160K	60,000
36,000	158K	60,000
38,000	156K	60,000
40,000	154K	60,000
42,000	153K	60,000
44,000	152K	60,000
46,000	150K	60,000
48,000	148K	60,000
50,000	146K	60,000
52,000	145K	60,000

The one final point that deserves discussion is the frequently expressed concern over 950-foot barrier runout versus 950 feet of runout surface or overrun. The 950-foot runout does not mean it will happen on every engagement. In fact, statistics show the 950-foot runout to be practically nonexistent. When it does occur, it happens at such low speeds that aircraft damage does not result unless a sharp dropoff exists at the end of the paved runout surface. During an engagement within barrier capabilities, the 950-foot runout is most often the result of coasting to the end due to not braking the aircraft in the last few feet of runout and/or failure to shut down the engine, again, during the last few feet of runout. If you'd care to try it, hook your VW to the barrier cable and drive away at 10 MPH. Believe it or not, you will run out the full 950 feet! Braking is applied to the barrier-type reels as a function of speed. As the engaged aircraft slows down, the tape reels slow down and braking decreases until minimum reel speed is reached. No further breaking is applied until the maximum barrier runout distance of 950 feet.

Well, that's about it on a large pinhead, but, don't be one! Know your aircraft and barrier limitations, prepare for engagement (time permitting) and hit it square in the center, brakes off.

See you at your next engagement. ★

the personal touch

One of the toughest problems of supervision is ensuring that the instructions, commands and desires of management reach the lowest level concerned and that they arrive ungarbled. The reverse is also true, because managers must know what the people are thinking and doing at all organizational levels. A short time ago a couple of letters were brought to our attention—letters from a wing commander to supervisors at two levels of supervision. The personal touch was evident in that the letters were written in the first person to the individuals' home address. In them, the commander, Col. Robert J. Hill, expressed his feelings on discipline, responsibility and job effectiveness. We understand the letters were well received. Other supervisors may wish to use this same method of communicating with their people, so, with Col. Hill's permission, we are reproducing one of his letters to a shop chief in the 390 Missile Wing.*

Dear Sergeant

I am addressing this letter to you because I know you are the one individual who can most positively assure the success of the program I am going to outline. You are the key supervisor in a line of supervisors that extends from me, the 390th Wing Commander, to the maintenance supervisor on the job. You manage the people who do the work. You set their schedules. You instruct, train and qualify them. You set the standards of quality, and the standards of performance. It is a fact of life that a boss or supervisor will get, with few exceptions, as low a standard of performance as his people find he will accept or as high a standard as they find he demands. Because I believe this, I want you to know that I charge you personally with the achievement of this important objective—to absolutely and positively assure yourself that personnel under your control are adhering 100 per cent to the procedures set forth in our technical data.

Adherence to technical data will make our working environment more safe for everyone and safety is paramount. We owe it to the public who surrounds us and to our military co-workers who are interdependent on each other for their personal safety.

Adherence to technical data will produce a weapon system that will experience fewer malfunctions. It will thereby be a more effective weapon system and produce more alert hours, and I want to emphasize this. The temptation to short cut or deviate from technical data to bring or keep a weapon system "into the green" is an indulgence we cannot afford.

Adherence to technical data will enable us to meet our flow schedules. I am not impressed by someone who can do a job in the shortest time but I am impressed by someone who always does the job properly. Our schedules will be laid out so that we can do the job with the procedures set forth in our technical data and meet the schedule. In short, you must emphasize that professionalism exhibits itself in "how the job is done," not in mere job completion.

You are being charged with a serious and important responsibility. I have no doubt you can execute it successfully.

Sincerely

Robert J. Hill, Colonel, USAF
Commander

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*Colonel Hill has since transferred to Frances E. Warren AFB as Commander, 90 Strategic Missile Wing (SAC).

THE B-52

Lt Col Harold E. Brandon
Directorate of Aerospace Safety

April 1966 marked the fourteenth year since the B-52 took off on its maiden flight. Since it entered the USAF inventory in June 1955, the B-52, with its nuclear capability, has been credited by many as the greatest war deterrent force in the history of the free world.

The B-52 airplane came into being as a result of over eight years of research and development. In June 1946, Boeing Aircraft Company was awarded a Phase I contract to proceed with the engineering study and preliminary design work on an inter-continental bombardment airplane. During the period February 1946 through April 1948 several models were designed and proposed to the United States Air Force. These models had various shortcomings in range, speed, altitude and desired fuel consumption. In October 1948 a completely revised airplane that met new concepts of speed and altitude requirements was presented to the Air Force. These new concepts became feasible as a result of new, improved jet engines and extensive high-speed wing research.

In March 1949 the construction of two turbojet airplanes began. The first B-52 airplane (the XB-52) left the factory in November 1951.

For years SAC's mightiest weapon, the B-52 owns a fabulous safety record. Photo upper left shows pre-production model with tandem cockpit.

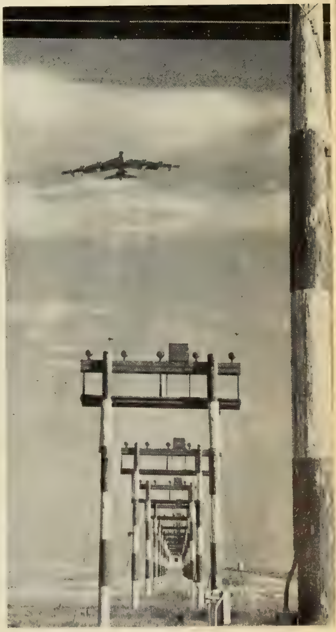
Engines and system ground tests were completed in January 1952, and the airplane was returned to the factory for installation of equipment not previously available. The second airplane, the YB-52, left the factory on March 15, 1952. On April 15, this airplane completed its first flight. It more than proved itself while undergoing the manufacturer's preliminary flight test evaluation program.

August 5, 1954, climaxed eight years spent in the development of the B-52 with the first flight of a production model, the B-52A, the *Stratofortress.* The first B-52A airplane was delivered to the Air Force for tactical use in June 1955. Delivery of the last B-52 H occurred in June 1962 to complete the production of 744 airplanes.

This is only a brief look at the evaluation of this jet bomber and how it was developed to become one of the most potent weapon systems devised for the employment of strategic air power. Its present usage in Vietnam is additional evidence of its flexibility and reliability in its secondary role of conventional bomber.

Since the B-52 was introduced into the active inventory in 1955, it has compiled one of the best safety records of any USAF tactical aircraft. The accident rate shows a near-steady decline through the years from 1956 to 1966. The chart below shows the highest rate was experienced in 1956 with almost yearly improvement to an exceptionally low rate of 0.3 for 1965. The rate, through August 1966, compares favorably with 1965.

While establishing this excellent flying safety record, the B-52 fleet has flown more than 2,953,000 hours. These hours, translated to distance flown, are equivalent to 53,169 times around the earth, or 5608 trips to the moon, using in excess of 73,800,000,000 lbs of fuel. ★



Missilanea

ALL OR NOTHING AT ALL!—There is no second chance for many of the space and research programs conducted by the Air Force today. These are the programs with one payload available, one booster (often specially modified for the effort), and one chance to succeed. Checklists and procedures must be developed, used only once, and then filed away. A single mistake or a materiel failure can cause a complete mission failure. This mission failure results in complete negation of the experiment's outcome and deprives the Air Force and the Nation of vital scientific and technical knowledge.

Many factors contribute to successful program efforts, including safety emphasis on reliability, maintainability, value engineering, or design engineering. Too often, safety considerations are not given the same level of support afforded other elements of the program.

We have heard many times that a program is "Safe" because reliability and maintainability are being stressed throughout the life of the program. These factors aid in promoting safety and accident prevention, but do not guarantee review of design, engineering, and operating procedures with adequate emphasis on safety.

A value in a high-pressure line may have excellent design features and operate within stated specifications. However, location of the valve may create a hazard due to inaccessibility or due to its proximity to electrical sources or a connection in a line containing noncompatible gas or fluid.

- During the first-stage burn, vibration and launch shocks cause leakage of the gases and an explosion occurs; a hoped for space "first" is a failure.

- A replaceable black box may exceed all required design criteria and still be a source of danger to the maintenance man who has to change it because access to the connections is blocked or impeded by lines, an electrical harness, or other chassis.

- A technician trouble shooting in accordance with established procedures is killed by application of power to a bus bar which he is touching. The man who applies the power is checking another system by approved procedures when the accident occurs. (No safety cross-check had been made when the procedures were written to insure one operation would not create a hazard to other personnel because of their working location.)

Mishaps such as these could be prevented by proper emphasis on safety during the design and development of the program. "All Or Nothing At all" not only means we have just one chance for success, but also emphasizes the need for using all of our skills, abilities and training during program design, engineering, and development to insure success. Safety must be an equal partner during a program's development to insure mission success. By THINKING safety, we can change the percentages and make success more likely than failure. ☆

Maj Paul S. Wood
Directorate of Aerospace Safety

FALLOUT

continued from inside front cover

SAFETY and thought I would try detecting the U-11's goof, being an off hours birdman myself.

It seems to me that if our friends in the U-11, since they were using a standard instrument departure route, could well have been monitoring the departure control frequency. Even VFRing it along, hearing someone behind them get a traffic advisory would have alerted them also to be looking around.

Unhappily enough when flying VFR, many pilots, relieved of the necessity for monitoring these track and reporting positions to ARTCC, set back and "unlax" too much. When the gear is up and locked, often their heads also are.

Enjoy your pubs very much.

LCDR L. A. Johnson, USN
Nuc-Power Dept, Submarine Safety Center
Groton, Conn.

Reference the story of the T-33/U-11 midair (October issue), the U-11 should have been at an odd-plus-500 feet altitude for his direction of flight.

A non-volunteer for O-1s in SEA

Regarding the article about the midair collision of the T-Bird and U-11, being a private pilot, it seems to me that a contributing factor to the collision was that the U-11 was at an improper flight altitude for VFR flight. On a heading of 137 degrees his flight altitude should have been odd thousand plus 500, not even plus 500.

A1C Al Harris
Box 3158
Edwards AFB, Calif

Page 11 of the October issue contained a challenge. The clues to the U-11 goof are:

- both airplanes on same SID,
- U-11, VFR, level at 4500 ft msl,
- T-33, IFR, assigned 5000 ft msl.

The implication is that the SID course is eastbound (based on the odd altitude assigned the T-33). Therefore, at 4500 feet msl, the U-11 was at the wrong altitude, viz., even plus 500, rather than the correct odd plus 500.

Please address your recommendation for flight duty assignment in SEA to Commandant of the Marine Corps, Code AAJ.

Lt Col J. G. Martz III, USMC
JTF-2, Sandia Base, New Mex

Your article on page 10, October issue, asks about the goof of the U-11. It should have been flying at an odd number thousand feet plus 500 on the 137 departure radial rather than the 4500 feet when he started cruising. While in the control zone he should have been monitoring the tower frequency though the tower here on a SID, even simulated, is to hand you over to the departure control frequency. If this had been done it would have allowed him to hear the conversation with the T-33 providing they were also VHF and not UHF.

Just got the article a few hours ago and this has been the first chance I've had to write a note. Hope my reply is the first in.

Rev Charles R. Young
Kingsley Field, Klamath Falls, Ore

ONE TAKER

Reference the October article, you have a taker. If the U-11 was flying outbound on 137 degrees departure radial, the cruising altitude should have been at an odd thousand plus 500 feet (e.g., 5500, 7500, etc). By leveling off at 4500 feet, he was at a VFR altitude for westbound (180°-359°) traffic. However, if the general terrain below was over 1500 msl, he was less than 3000 feet above the terrain and thereby not goofing.

I'll be proud to accept the title of "VFR Pilot of the Month," and I am ready to fly O-1s in SEA. There are two unique factors which you should include in your recommendation: I am presently in SEA (DaNang AB, Vietnam) but I do not have any kind of USAF aeronautical rating. However, I have an FAA commercial pilot's license with SEL, instrument, and certified flight instructor ratings. Further, I am the proud owner of a Cessna 172 which, alas, is being flown by others than me.

Anxious to fly again,
Maj Everett G. Groves
1972 Comm Sq
APO San Francisco 96337

These are all of the replies we have room for, and we're convinced that

1. You folks are reading the book;

2. The Air Force has its share of sharpies.

THE IPIS APPROACH

We have just read the September issue of AEROSPACE SAFETY and must say that your magazine belongs to the four most-read papers at our facility. We receive it regularly in turn for our magazine "The Controller."

Among the most discussed articles are "The IPIS Approach," "FAA Advisories" and "Aerobits."

In respect to the "IPIS Approach" articles we should like to join 1st Lt William N. Payne in his opinion; they are excellent and help us a lot in our controller training. Would it be possible to obtain all the IPIS Approach articles from the USAF Instrument Pilot Instructor School (ATC) at Randolph AFB and what would be the cost?

Looking forward to your kind reply,

Frank W. Fischer
German-ATCA
Chapter: Birkenfeld-UACC
6589 Niederhambach, Boschweiler 20
West Germany

IPIS says a package is on the way.

HELP THYSELF

The photograph on page 9 (August issue) helps to illustrate the challenge faced by Search and Rescue (SAR) personnel. It reminds me of the importance of the old adage "Help Thyself" and how much the adage applies to a SAR situation.

Page 18 (in the same issue) is definitely a step in the right direction, however the ultimate has not been achieved. The parachute canopy should be raised vertically as well as spread horizontally and in this instance the cactus at the extreme right might assist in attaining this objective. This would create a contrast on the horizon which is very important in SAR operations since the chances of flying directly over the downed survivor are limited.

Suggest more illustrations in the life support area be included in future volumes of AEROSPACE SAFETY.

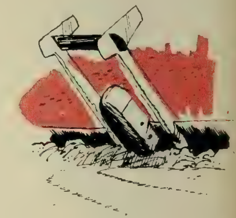
Capt George D. Keltner
Wing Physiological Support Officer
Hq 4756 Air Defense Wg (Trng)
Tyndall AFB, Florida 32401

We're planning more PE/survivor illustrations. In fact, see the back cover.

AEROBITS

SNOW ON THE RUNWAY causes accidents every winter season. Early this year a C-131 prop struck a small patch of snow during rollout. The propellers were in reverse and one blade was damaged sufficiently to necessitate a prop change. The runway looked smooth from downwind leg with no indication of patches or ridges. This goof was caused by a poor job of snow removal.

The next day a C-119 pilot used bad judgment in attempting to take off from a strange field at night, knowing that runway conditions were poor. During the takeoff attempt the aircraft struck a snowbank. The pilot lost control, wrecked the aircraft and wound up with a major accident. Careful preparation and constant vigilance by airport managers and increased respect for winter conditions by our pilots can reduce or eliminate this type of mishap.



F-100 COOKOUT—The pilot started his instrument departure with the defrost lever full forward. When he attempted to turn the defrost off, the handle broke leaving the control in the full hot position. The cockpit quickly became uncomfortable so the decision was made to select manual full cold. The pilot accidentally selected full hot and the climate in the cockpit was soon unbearable. He decided to land immediately. High gross weight and a quartering tail wind necessitated a long, fast landing which terminated in a BAK-9 engagement. The externals were jettisoned about 1500 feet prior to contact. Materiel failure was the prime culprit, but the situation was compounded by the mistaken selection of manual full hot with the cockpit temperature control switch. Crewmembers must periodically review all methods of reducing cockpit temperatures, including jettisoning the canopy.

JET ENGINES have to be babied. In fact, like babies, when you feed them the wrong thing, be prepared to suffer the consquencs. Like:

- After the F-104 pilot shut down the engine he took the Form 781 from the top of the bay and discovered that his blue wool cap was missing. The cap couldn't be found anywhere in or around the aircraft, the engine was inspected with the following results: several rotor blades nicked enough to require a compressor rotor change; small bits of cap in the aft stages of the compressor section.
- While the T-38 was taxiing after landing and the rear canopy had been opened, the Nr 2 engine popped, EGT went to above 900 degrees and the hot flag came on. The culprit was a high altitude FLIP enroute chart that blew out of the cockpit and into the engine. Luckily, the chart lodged on the front frame of the engine and caused no damage. Nevertheless, an engine teardown was required and all first and second stage turbine blades were changed because of the overheat condition.
- FOD comes in many forms and visits many places, so engines are not the only vulnerable spot. For example: During formation takeoff roll in a T-38, the

student applied back pressure to rotate but couldn't move the stick aft. He retarded the throttles for an abort, but the IP, suspecting improper throttle technique, pushed the throttles to max power. The student then advised the instructor that he couldn't get the stick back. The IP took over and the aircraft eventually wound up in the barrier. The problem was a 2½ inch paper clip that had been lost in the front cockpit and lodged in the stick well.

If it's loose, nail it down, tie it down, screw it down, bolt it down or put it in a tool box, map case, pocket or other suitable container. Foreign objects near an aircraft are like coyotes at a chicken ranch—you had better not let them loose.

CONTINUED USE OF THE SAME OLD CHECKLISTS AND PROCEDURES can easily lead to complacency and a one-way ticket to oblivion. Yet every crewmember must continue to religiously use the same old checklists and procedures — unless he welcomes hair-raisers such as recently befell one of our USAF crews.

A reconnaissance crew finished its low altitude mission and climbed to FL 300 for the return to home plate. The backseat driver removed his oxygen mask to blow his nose; he then wiped his glasses and proceeded to tidy up the cockpit. About 15 minutes later he failed to respond to a question asked by the aircraft commander. The AC couldn't see the Pilot Systems Operator in the rear view mirror so he banked the aircraft to get his attention.

After this action he could see his partner's head leaning against the canopy and knew that the PSO was unconscious. Immediate descent, SIF to emergency and MAYDAY to the radar control agency were executed. About this time, the AC noted that the emergency vent knob was out (unless this knob is in, the aircraft cannot be pressurized) and pushed it in; the cabin pressure altimeter read 28,000 feet and was decreasing rapidly. While descending, the AC went to emergency oxygen. The pilot in the rear cockpit raised his arms against the canopy as the aircraft passed through 10,000 feet but he did not go to 100 per cent oxygen until descent to 4000 feet.

Approach Control vectored them to a visual final and advised the aircraft commander to contact tower if he was VMC. After two visual passes at the runway were aborted, he realized that he was dizzy and disoriented, had been breathing hard and rapidly on 100 per cent oxygen, and had hyperventilated. Therefore, he removed his oxygen mask, held his breath, began handling the bird in a normal manner and recovered without further incident. (Life Sciences points out that the pilot's self treatment for hyperventilation is erroneous and very hazardous. Breath holding after a period of hyperventilation can produce "reflex cardiac arrest" (stoppage of heart beat) and unconsciousness as the brain is deprived of blood. The proper corrective action is to consciously resume slow normal respirations at a rate of 15/min. The symptoms will soon dissipate!)

What started it all? The pre-engine start checklist was not followed in sequence because the pilot's attention was diverted by the crew chief who was leaning into the cockpit while standing on the aircraft ladder—the pilot failed to notice that the vent knob was not in. Thus, when the oxygen mask was removed, the Pilot System Officer was breathing ambient air. Oxygen discipline was ignored when the PSO failed to inform the AC that he was removing his mask.

AERO BITS

REMINDER—During this present day of sophistication we must keep in mind that "when the greatest of all navigational systems fail" the pilot still has the job of getting himself and his flying machine home. Needless to say needle, ball, and airspeed is certainly not the desirable way to fly instruments; however, we all know that this system will work for the proficient pilot. Likewise we must keep in mind that pilotage and time-distance navigational procedures are also accurate when properly applied to the problem at hand.

The stand-by magnetic compass will keep you headed in the right direction if you are familiar with its use. This familiarity cannot be called upon instantaneously if you haven't used it for a number of years. Naturally, as professionals we know all about variation, deviation, magnetic dip, acceleration error, and oscillation error, but for those who are a bit fuzzy on the subject it is suggested that you review Chapter 5, AFM 51-37, Instrument Flying, dated 20 January 1966.

Knowing all about your navigational equipment is another life insurance measure that we can ill afford to be without.

Do you know how to use the magnetic compass?

Do you know the variation in the areas where you fly?

Do you really know the forecast winds along your route of flight?

Do you verify these winds while everything is working during the flight?

Have you worked a wind vector problem recently?

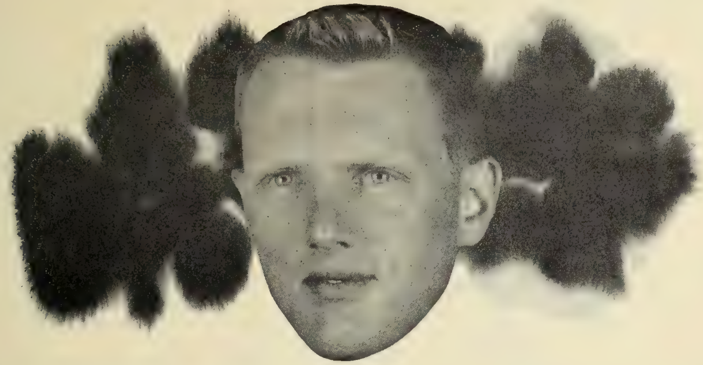
A working knowledge of all of the above, plus some occasional practice will not only provide you with a sense of pride as a pilot but will also help you to complete your mission if some of your sophisticated equipment goes sour and as a by-product this type of navigation know-how may keep you out of serious trouble—such as violations of restricted areas, buffer zones, and prohibited areas.

Lt Col H. K. Boutwell
Directorate of Aerospace Safety

SAFETY OFFICERS—There have been reports that some bases are not receiving their authorized quota of Safety Officers' Kits. You can help the Distribution Office by checking with your units to find out which of the three kits are not being received, and forwarding such information to AFIAS-E4, Directorate of Aerospace Safety, Norton AFB, Calif. 92409. ★

☆ U. S. GOVERNMENT PRINTING OFFICE 1966 251-211/3

WELL DONE



1ST LT AUSTIN P. SNYDER

113 TACTICAL FIGHTER SQ., HULMAN FIELD, TERRE HAUTE, IND

On 14 January 1966, 1st Lt Austin P. Snyder was flying a local night instrument mission in a unit equipped F-84F. He climbed to 20,000 feet and received permission from Approach Control to execute a VFR practice ADF penetration and approach to runway 23. As he was inbound to high station, he noted a C-130 beginning an ADF penetration. On the ADF low approach Lt Snyder passed ahead of the C-130 and shortly thereafter executed a missed approach.

At this time Lt Snyder proceeded to a point approximately 15 miles south of the field and started a climb to 20,000 feet to practice a VFR TACAN penetration and approach. At 12,000 feet, the cockpit lights dimmed twice and the generator failed. Before Lt Snyder could reduce the electrical load and complete applicable emergency procedures, he had complete electrical failure.

Lt Snyder took out his flashlight, placed it between his knees, and used it to complete his emergency procedures and maintain control of the aircraft. He turned in the general direction of the field but haze layers prevented its location. At this point, without the use of navigational aids, due to complete electrical failure, and unable, because of the haze, to find the runway, he remembered the C-130 which he had previously passed and realized that if he could again locate the transport it would be his ticket to final approach and a safe landing.

Fortunately, the C-130 driver had decided to shoot another approach. Picking up its rotating beacon, Lt Snyder was able to follow the transport in on low approach and, finally seeing the runway lights, was able to land.

A successful landing, without engaging the barrier, was accomplished without the use of trim, flaps, speed brakes, or drag chute. Lt Snyder's ingenuity, professionalism and outstanding performance no doubt averted a serious accident. WELL DONE! ★

COMMUNICATIONS TECHNIQUES

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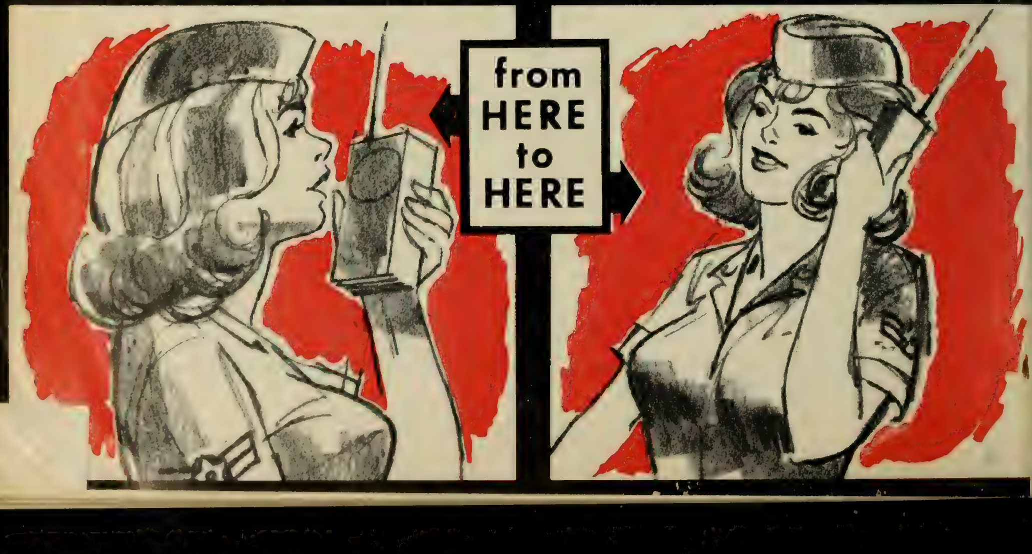
PROBLEM: The cover pilot communicating with downed airman uses normal radio techniques and answers immediately when downed airman finishes talking. By the time the downed airman moves the radio from mouth to his ear, the airborne pilot is half way through his message. This requires downed airman to ask for a repeat message and above circumstances repeat.

ACTION: DO NOT ANSWER OR REPLY IMMEDIATELY. GIVE THE DOWNED AIRMAN TIME TO MOVE SURVIVAL RADIO FROM HIS MOUTH TO HIS EAR BEFORE YOU TRANSMIT TO HIM.

NOTE: Downed airman—Turn off beeper when using hand held UHF.

WHEN TALKING TO DOWNED AIRMAN USING SURVIVAL RADIO, HOLD VOICE TRANSMISSIONS UNTIL SURVIVAL RADIO IS MOVED....



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